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VOLUME 20 September, 1954 NUMBER 9

THE AMERICAN SURGEON

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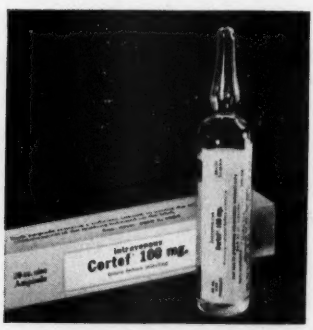

Entered at the Post Office in Baltimore, Maryland as second-class matter.

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The American Surgeon

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The American Surgeon is published for the advancement of surgery. It is the official journal of The Southeastern Surgical Congress and The Southwestern Surgical Congress.

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Correspondence pertaining to advertising and non-member subscriptions should be sent to the Publishers, Mt. Royal and Guilford Avenues, Baltimore 2, Md.

Correspondence pertaining to subscriptions of members of the two Congresses, and business matters relating to *The American Surgeon* and the two Congresses should be sent to Dr. B. T. Beasley, 701 Hurt Building, Atlanta 3, Georgia.

Change of Address. Publisher must be notified 60 days in advance. Journals undeliverable because of incorrect address will be destroyed. Duplicates can be obtained (if available) from the publisher at the regular price of single issues.

Subscriptions. The American Surgeon is published monthly, and twelve issues in a calendar year constitute a volume. Subscriptions are sold on a volume basis.

Subscription price in the United States and countries in the postal union: $10.00 per volume. In countries outside the postal union: $11.50. Single copies, when available, $1.00.

Publisher

THE WILLIAMS & WILKINS CO.

Mt. Royal & Guilford Aves., Baltimore 2, Md.

(In writing to advertisers, please mention the journal—it helps.)

THE
AMERICAN
SURGEON

Vol. 20, No. 9 September, 1954

OBSTRUCTIVE JAUNDICE: ITS DIAGNOSIS AND TREATMENT*

WALTMAN WALTERS, M.D.

Rochester, Minn.

According to Moynihan, "No one living is infallible in the differential diagnosis of obstructive jaundice." This was true when I quoted these words[11] 26 years ago at a meeting of the Tennessee State Medical Association and still holds today, although in the interval many additions have been made to the knowledge of hepatic function and control of infection. Both preoperative and postoperative care of patients have improved, and improvements have been made in surgical technic, principally the more radical operations for carcinoma of the ampulla of Vater and in the head of the pancreas. Unfortunately, I am sorry to say, these improvements and extension of the operation have not prolonged life greatly, especially the life of patients with cancer of the head of the pancreas.

Twenty-six years ago the risk of operation in cases of obstructive jaundice was more than 10 per cent. Now it is approximately 3.5 per cent for benign lesions and varies beyond this for malignant lesions, depending on the nature of the surgical procedure. The risk of radical resections of the head of the pancreas and the duodenum, and the lower part of the common bile duct, will vary from 15 to 18 per cent whereas the risk of palliative biliary intestinal anastomosis is only a few per cent.

AIDS TO DIAGNOSIS

Methods of clinical diagnosis of lesions of the biliary tract remain about the same. In my opinion, they continue to hold the most prominent place in diagnosis and in the determination of operative risk. However, certain tests of liver function, such as determinations of the prothrombin time and the values for

* Read at the meeting of the Southeastern Surgical Congress, Birmingham, Alabama, March 8 to 11, 1954.

From the Section of Surgery, Mayo Clinic and Mayo Foundation, Rochester, Minnesota. The Mayo Foundation is a part of the Graduate School of the University of Minnesota.

protein and fat constituents of the blood, have given additional practical information.

Painless progressive jaundice in middle-aged patients with acholic stools usually is due to a malignant lesion unless the patient has had a previous operation on the biliary tract, in which case it may be due to a stricture of the common or hepatic bile ducts. If the gallbladder is distended and palpable, there is an 80 per cent chance that the obstructing lesion in the head of the pancreas is malignant but it must not be forgotten that approximately 15 to 20 per cent of such pancreatic tumors may be benign.[5] Intermittent jaundice following attacks of upper abdominal pain usually is due to a benign lesion, most often a stone, or possibly to stricture of the common duct if the patient has had a previous operation.

Although improvements have occurred in the visual demonstration of normal gallbladders by the development of new iodine compounds which more readily pass through the liver and into the bile than was the case in the nineteen hundred and twenties, unfortunately, concentration of these dyes in the bile within the common bile duct still is insufficient to show a common duct stone, except in the rarest instances.* In the 33 years during which I have been studying patients with complicated lesions of the biliary tract, I have seen less than 10 patients in whom a common duct stone was found on roentgenographic examination of the abdomen, either with or without a cholecystographic medium having been administered.

Improved tests of liver function have helped in the differential diagnosis of intrahepatic versus extrahepatic biliary obstruction but they are more helpful when taken together and correlated with the clinical history to provide information of liver function.

The tests available at present give more accurate information of liver function than previous tests when the results are assembled. They are helpful in differential diagnosis and in indicating the risk of a surgical operation. Yet, when the history of the disease and the patient's response to it are at variance with results of these tests clinical judgment is necessary and should be relied upon. Among the most important tests and observations in forming a clinical opinion of the risk of surgical procedure, I believe, are the tests for prothrombin in the blood and if prothrombin time is prolonged, the preoperative response of the prothrombin in the blood to vitamin K. Normal values for serum proteins with a ratio of albumin to globulin of 2:1, together with the clinical observation that the patient's general condition seems satisfactory, afford a good idea that the risk of the surgical procedure is not too high. They may be relied upon even when the other tests of liver function indicate poor function.

Last September I operated, for stricture of the common bile duct, upon a deeply jaundiced patient who had values for serum bilirubin of 10.6 Gm. per 100 cc. direct and 2.3 indirect. On admission the prothrombin time was 46

* Since the writing of this paper, a new iodine compound for use in cholangiography has been developed abroad (Biligrafiin) and in this country (Cholegrafin) which concentrates in the common and hepatic ducts in about 86 per cent of cases.

TABLE 1

Laboratory Findings in a Case of Obstruction With Jaundice

	Normal	Preop. 9-26-53	Postop. 10-14-53
Cholesterol, mg. per 100 cc. of plasma	150–250	906	523
Cholesterol esters, mg. per 100 cc. of plasma	100–175	182	363
Phospholipids, mg. lecithin per 100 cc. of plasma	200–250	2,020	480
Fatty acids, mg. per 100 cc. of plasma	250–400	1,674	792
Lipides	400–650	2,580	315
Phosphatase, alkaline units per 100 cc. of serum	14	198	
Thymol turbidity, units	0–4	2	
Zinc sulfate, units	6–16	4	
Cephalin cholesterol	No floc.	No floc.	

seconds but after two days of treatment with vitamin K and a blood transfusion it dropped to 19 seconds. Serum proteins were normal and the albumin-globulin ratio was 3.6:2.5, which is normal. These data were most significant in view of her good general condition, yet other studies of liver function showed greatly elevated values and her sedimentation rate was 100 mm. in one hour (Westergren method).

The patient made an excellent recovery after choledochoduodenostomy made over a Mayo-Sullivan tube which, of course, completely relieved the jaundice. The effects of this relief of biliary obstruction are clearly illustrated in the third column of table I comparing postoperative and preoperative values.

This case is a good one in point to illustrate the fact that the clinical appearance of the patient and normal values for some of the important tests of liver function indicated the patient's condition better than did many of the detailed and less frequently used tests.

PREOPERATIVE PREPARATION

I began the preparation of jaundiced patients for operation in 1923 after studies by Bell[1], Bowler and myself[12] on the value of 10 per cent solution of calcium chloride intravenously injected to reduce the blood coagulation time of jaundiced patients and reduce the incidence of bleeding. This was used with considerable effectiveness at the Mayo Clinic in these cases until vitamin K was introduced by Butt, Snell and Osterberg[3]. These colleagues of mine used to prepare their own vitamin K by placing putrid fish remnants in capsules. The active principle of vitamin K was later made available and its use has become routine in preparation of jaundiced patients for operation. In the absence of a badly damaged liver it will reduce the prothrombin time to normal in 24 to 48 hours, and, as a result, practically prevent serious postoperative oozing which frequently, in the old days, could not be stopped. More recently a new vitamin K substance called "Vitamin K_1" has been developed whose activity in immediately reducing a prolonged prothrombin time is astonishing. A period of three or four days' preparation for operation of the jaundiced pa-

tient continues to be of great value. During this time, in addition to vitamin K, the patients receive a high-carbohydrate, high-protein diet, if they can take it; if not, they are given 5 per cent solutions of glucose in normal saline solution intravenously twice a day and a blood transfusion.

The blood groups of all patients with obstructive lesions of the biliary or gastrointestinal tract, and indeed of all patients who are to have major surgical procedures, are determined and the blood of each is crossmatched prior to operation with at least 500 cc. of blood. The advantage of this is obvious for frequently the jaundiced patient has more than an average degree of anemia. A transfusion of 500 cc. of blood is given preoperatively if the concentration of hemoglobin is 10 Gm. or less. Moreover, if during the operation bleeding is excessive, or if the operation lasts too long, a second or even a third bottle of crossmatched blood is given.

DIFFERENTIAL DIAGNOSIS

I should like to discuss a little more the salient points in differential diagnosis of the different types of biliary obstruction. I have spoken of the painless progressive obstructive jaundice as being indicative of a malignant lesion of the duct or the head of the pancreas, and the painful attacks of biliary colic with jaundice, chills and fever, being characteristic of a benign obstruction of the common duct, usually stone. It is important to emphasize, however, that stones may be present in the common bile duct without producing jaundice or without evidence of infection, as characterized by chills or fever.

In a recent paper my colleagues Waugh, Johnston and Cain[18] reported observations on 175 patients with common duct stones operated upon by Waugh. Although biliary colics occurred in 79 per cent of the patients, 35 per cent did not have a history of jaundice, and about 50 per cent did not have chills or fever, or both. The most frequent symptom with the biliary colic was nausea and vomiting which occurred in 75 per cent of the patients.

Several years ago I called attention to the fact that small stones in the ampulla could produce reflex spasm of the pylorus producing pain which was accentuated by the taking of food and lessened by varying degrees of starvation. In these patients, therefore, considerable weight was lost. This loss of weight associated with pain after a previous operation on the gallbladder for stones frequently has led to the finding of a stone in the common duct at operation.

Perhaps this would be as good a place as any to say, that with the exception of the malignant lesions producing obstructive jaundice, the best way to prevent biliary obstruction from developing is to impress patients and their physicians with the importance of removing the diseased gallbladder when the disease is confined to it rather than to delay until stones obstruct or perforate the gallbladder or enter the common duct and produce jaundice or infection of the liver and pancreas. Pancreatitis and cholangitis may continue even after removal of an infected gallbladder which has repeatedly infected them.

Another way of preventing obstruction of the common bile duct by stones is to recognize their presence at the time of operation upon the gallbladder. This

can be done in several ways; whenever operations are carried out on the gallbladder the common and hepatic ducts should be demonstrated as well as the cystic artery and the cystic duct. If this is done, it will enable the surgeon to perform cholecystectomy without injury to adjacent structures. It will enable him to recognize an enlarged common duct which always should be opened and explored with scoops for stones and thoroughly irrigated with water to force any small stones in the intrahepatic ducts out through the incision in the common duct. Moreover, the exploring scoop should be passed gently through the ampulla of Vater and the duct palpated in that vicinity while the scoop is in place. This will enable the surgeon to recognize and remove ampullary stones. This maneuver should be repeated until the exploring 4 mm. scoop can be passed readily through the ampulla into the duodenum without further obstruction. It is easy to force such a scoop through the wall of the duct above a small impacted stone, and sometimes it is easy to pass a scoop by an ampullary stone. Therefore the surgeon must palpate the duct with the scoop in place and while it is extending through the sphincter into the duodenum.

It is true that sometimes associated pancreatitis with swelling of the head will make it difficult to ascertain the condition of the lower end of the duct. However, if the surgeon persists in trying to palpate it in its relation to the scoop extending through it, in every case he can determine accurately the condition of the lower part of the duct. By this method of the exploration of the duct I have overlooked relatively few stones; in fact to my knowledge only four since my return from the service early in 1946. I know this to be a certainty because, whenever I explore the common bile duct, I insert a T tube and about the twelfth or fourteenth day after operation a cholangiogram is made and three roentgenograms are exposed in a period of 10 minutes. Such roentgenograms enable one to determine whether the duct is still enlarged; if it is, the T tube should be left in until the duct returns to normal size. They also show filling defects in the duct which are suggestive of stones if any stones remain. I have seen some patients in whom an air bubble led to the erroneous opinion that a stone had been overlooked. A later cholangiogram no longer showed this circular defect.

TUMOR OF PANCREAS

Now what of the patient who is jaundiced and who at operation is found to have a distended gallbladder, and a hard tumor is palpated in the head of the pancreas? In my paper before the Tennessee Medical Association[11] of 1928 I reported the results of the conservative operation of cholecystgastrostomy or cholecystduodenostomy in the management of such cases, and described several cases in which the patients had lived free of jaundice and were comfortable for many months, and some up to one, two and three years. At that time, there was no thought of radical amputation of the head of the pancreas and its adjacent structures, the first and second portions of the duodenum, and the lower part of the common bile duct, as recommended in recent years by Whipple and Parsons[19], Brunschwig[2], and Waugh[17]. This procedure is a gigantic one and

should be undertaken only by the most experienced surgeons and for lesions which are small and easily movable. Even then it is questionable whether the risk of the operation is warranted in view of the fact that few of these patients live more than 12 months.

Last year McDermott and Bartlett[7] reported on a study of 132 patients with pancreaticoduodenal cancer admitted to the Massachusetts General Hospital from Jan. 1, 1931 to Dec. 31, 1940, and 183 admitted from Jan. 1, 1941 through Dec. 31, 1950. They found that the average duration of life after pancreaticoduodenectomy was only 11 months, and that the average survival period had not increased since the addition of radical surgical procedures to the previously employed palliative procedures. We at the Mayo Clinic and they have found that cancer of the ampulla of Vater carries a more favorable prognosis than cancer originating in the head of the pancreas. Of their series of cases they said, "the average survival in carcinoma of the ampulla of Vater has not been altered appreciably by the introduction of resection for cure although in this series, as in other reports, there were a few long survivals after resection. One patient lived over five years and another four years after resection. Both died of recurrent disease. . . .it is possible to say that 'resection for cure' may have extended the survival of a few patients and may achieve isolated five-year cures. Certainly it has not yet accomplished the results for which one might have hoped."

With this opinion my colleagues and I agree although in our experience we have had a little better result in survival rates in the patients upon whom the radical operation was done for carcinoma of the ampulla of Vater. I think that the radical operation should be done for malignant ampullary lesions in all cases, providing of course the patient's condition permits. It should be done also in those few patients in whom the tumor in the head of the pancreas can be proved to be malignant and is small enough to permit resection without damage to the superior mesenteric vessels or to the hepatic artery and portal vein.

My colleagues, Priestley and Waugh, and I have removed small specimens from the head of the pancreas with the Silverman needle for microscopic examination, but generally speaking, I dislike doing so for fear of damaging the pancreatic duct or its branches and causing leakage of pancreatic fluid with serious results. It is to be remembered too that, as Hartman[5] showed many years ago, 20 per cent of tumors of the head of the pancreas producing jaundice may be inflammatory and that under these circumstances, especially if the tumor is large, it is much better to be content with the conservative operation of biliary intestinal anastomosis than to attempt resection. In some patients of this sort I have done a cholecystenterostomy as a preliminary procedure even when the lesion was small and without the stony hard feeling of carcinoma and have advised a "second look" surgical exploration from 8 to 10 weeks later if the patient's condition permitted, to see if radical resection should be done. In some such patients the lesion was proved to be cancer and the lesion resected, in others the tumor had seemed to disappear and hence it was assumed

TABLE II

Results of Operation for Stricture of Biliary Ducts
1924–1951 Author's Series

Anastomosis or operation	Period*	Traced cases	Well	
			No.	Per cent
Hepatic duct to duodenum	A	54	29	54
	B	32	17	53
Hepaticojejunostomy	A	0	0	
	B	1	0	
Common duct to duodenum	A	40	33	82
	B	7	5	71
Duct to duct	A	18	10	56
	B	21	15	71
Hepaticostomy	A	12	2	17
	B	6	1	17
Other	A	14	7	50
	B	0	0	

* A = 1924–1947; B = 1948–1951

to be inflammatory. Such cases have been few in number, it is true, but I refer to them to show what I believe to have been reasonable procedures under the circumstances.

STRICTURES OF THE COMMON DUCT

In every presentation on biliary obstruction it is necessary and important to make some comments on stricture of the common bile duct. I have operated upon more than 325 such patients since 1924 and have reported from time to time follow-up results.[9, 10, 13, 14, 16] The number of cases in which the different procedures for stricture have been carried out and the results of operation are shown in table II. With increasing experience over the years the ends of more ducts were found and more opportunities were presented, therefore, for either direct anastomosis of the ends of the duct or of the proximal end of the duct to the duodenum. Both methods of anastomosis have yielded from 56 to 82 per cent of excellent results, in spite of the fact that many of the patients had had previous operations for stricture. Obstruction will recur and has recurred in 10 per cent of my own patients, in some not until years later. In these and in other patients in whom previous operations have been performed successful results have been obtained.

Last week I had the pleasure of seeing a patient, who returned for a call en route from Florida to Canada. I first operated upon this man for stricture of the common bile duct in 1934, and performed hepaticoduodenostomy. He was well for 12 years; then partial contracture of the hepaticoduodenal stoma occurred. After he had had attacks of abdominal pain without jaundice I reconstructed the hepaticoduodenostomy over Mayo-Sullivan tubes. In 1950, because of right upper abdominal pain without evidence of obstruction, and with

the roentgenographic diagnosis of duodenal ulcer, I performed transabdominal posterior gastroenterostomy and vagotomy. Symptoms were relieved for two years. Then he began to have attacks of biliary colic again. On this occasion there was slight jaundice. At operation contracture of the hepaticoduodenal stomas had partially occluded the right hepatic duct but not the left, and hence the patient was not deeply jaundiced. The openings in the ducts and in the duodenum were enlarged and an accurate anastomosis was made of the ends of both hepatic ducts to the duodenum over two T tubes. The tubes were left in for several months and then removed. Since then the patient has enjoyed excellent health with complete relief of pain. How long this will continue remains to be seen.

This brief history tells much of the story of stricture of the common duct and its symptoms, and is again illustrative of the fact that incomplete biliary obstruction can occur and produce attacks of pain without jaundice, chills or fever.

The subject of stricture should not be left without mention of the fact that stricture of the common bile duct should not occur. Almost, without exception, in each of the patients with stricture upon whom I have operated, the stricture has been postoperative and in most patients it has been traumatic, although infection possibly may have played a role. The lesson to be learned is that cholecystectomy should be performed only when the cystic duct, the cystic artery and the common and the hepatic bile ducts can be identified.

What of those patients in whom no extrahepatic bile duct is found at reoperation? In many of these patients what seems to be total absence of an extrahepatic bile duct is due to the fact that the hilus of the liver overlies the part of the duct above the stricture. If one retracts the hilus of the liver upward and outward frequently one can find a fringe of duct of sufficient length to anastomose to the duodenum or to the jejunum. Whenever this is not the case, I have been successful in finding dilated intrahepatic ducts by the introduction of a needle into the hilus of the liver. When the aspirating needle finds such a duct, I leave the needle in place and make an incision along the needle into the duct and insert a tube. In several of these patients[15] the pressure of the tube in the duct against the side of the duodenum has produced a small area of necrosis, and spontaneous fistulization has occurred between the biliary and intestinal tract. I have demonstrated the communication in some patients by injection of the sinus with a radiopaque substance. In some of these cases after the patient's jaundice has subsided and the liver has decreased in size, biliary obstruction has recurred and at reoperation sufficient duct has been found to make a direct anastomosis to the intestine. Whether this duct was hidden by an overlying enlarged liver at the previous operation or whether I failed to find it for other reasons at the time of the first operation is speculative.

Because ingested barium may enter the biliary tree in cases of biliary duodenal anastomosis some of my friends have questioned the effect of liquids or food entering it and whether biliary duodenal anastomosis is as satisfactory as anastomosis with a defunctionalized loop of jejunum. (This latter procedure

was recommended by Cole[4] and Allen.) In practically all of the patients on whom I have performed biliary intestinal anastomoses, I have preferred to anastomose the duct to the duodenum for several reasons: (1) because I have seen signs of infection only in those patients in whom the anastomosis has contracted and obstructed and (2) because the duodenum is the place where the bile normally enters the intestinal tract and (3) because biliary duodenal anastomosis is less of a surgical procedure than biliary jejunal anastomosis and therefore carries less risk. Most patients with strictures of the bile ducts, particularly those who have had more than one operation, are jaundiced and many of them have a good many adhesions. In these patients the stump of the duct frequently can be approached without too much difficulty and with little bleeding by dissection close to the liver, and with the duodenum so close by and handy, anastomosis to it seems the appropriate procedure.

Recent experimental studies made by Musgrove, Grindlay and Karlson[8] and by Kleinert and Large[6] indicate that in dogs the hepatic damage is less after biliary duodenal anastomosis than after biliary jejunal anastomosis.

Operative procedures for correction of strictures of the common bile duct are long and tedious and sometimes exceedingly difficult. When a surgeon is successful in finding the end or the ends of the duct and relieving the obstruction, he feels satisfaction in knowing that he has in most cases probably enabled the patient to live his life without jaundice, itching or fever.

A word about the remarkable value of the proper antibiotics in controlling postoperative biliary infections: I have had 3 patients, 2 recently, in whom blood stream infections developed after exploration of the common duct and relief of the obstruction. Two patients had stones in the common ducts. One patient had a Proteus infection which responded to a combination of oxytetracycline (terramycin) given intravenously, dihydrostreptomycin given intramuscularly, and erythromycin given orally. The infection of the other 2 patients was due to a gram negative bacillus of the colon group. This responded to a combination of oxytetracycline and dihydrostreptomycin. In another patient a streptococcic infection of the blood stream after hepaticostomy was controlled by administration of 20,000,000 units of penicillin twice daily after other antibiotics failed. The corollary of this is that sensitization tests should be run to see what antibiotic is most effective.

SUMMARY

The clinical manifestations of biliary obstruction and the patient's general condition continue to be the best indices of the types of obstruction as well as of the risk of the operation. The development and improvement in so-called profile tests of liver function have assisted materially in determining the function of the liver, but if results are at variance with the clinical findings, they are not to be interpreted as being conclusive of the ability of the liver to withstand a surgical procedure or to respond to it. In such patients determinations of the prothrombin time and, if this is elevated, its response to vitamin K, the amount of protein in the blood serum, and the quantity of the albumin and

globulin are of greatest practical importance. The administration of vitamin K prior to and following operation has practically eliminated the possibility of tissue oozing and bleeding, and has been a great addition to therapy of the jaundiced patient. Likewise intravenous administration of solutions of glucose and transfusion of blood have been of great value when the patient is anemic, and when the patient's liver function tests show great disturbance.

Progressive painless jaundice in the middle-aged patient with acholic stools, without bile in the duodenal contents, usually is indicative of a malignant lesion in the lower part of the common bile duct, especially if the gallbladder is palpable. Intermittent jaundice associated with attacks of pain is usually the result of a benign lesion and may be due to a stone in the common duct, and infrequently to pancreatic obstruction with associated cholangitis.

In the treatment of malignant obstructing lesions of the biliary tract the conservative operation of biliary intestinal anastomosis has relieved the jaundice and the itching at a low risk and has given almost the same survival period in most of the patients as resection of the head of the pancreas. On the other hand when the lesion is confined to the ampulla the procedure of choice is radical resection of the head of the pancreas and first and second portion of the duodenum, the lower part of the common bile duct and the adjacent glands. This procedure has prolonged the life of many patients, and some of them have lived well beyond two and three years, with some so-called five year cures.

The best way to prevent benign obstructing lesions of the biliary tract is to remove the diseased gallbladder when the disease is confined to it rather than to wait until the stones obstruct the cystic duct or enter the common duct and produce various and serious complications. Most of these complications are accompanied by some variable degree of jaundice, and all are accompanied by continuation and extension of the infection to the liver and the pancreas.

Antibiotics have eradicated blood stream infections following operations for obstructive lesions of the biliary tract but sensitivity tests should be made to determine the most effective agent.

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EXTENSION OF GASTRIC CANCER IN THE INTRAMURAL LYMPHATICS AND ITS RELATION TO GASTRECTOMY*

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It is well recognized that the results of treatment of cancer of the stomach have been much less satisfactory than those obtained in cancer of the colon, even though the lesions in both instances look much alike grossly and microscopically. The reasons for this difference in end results are not entirely clear, although several factors seem to be operative. First, the symptoms of cancer of the stomach may be so inconsequential that the diagnosis is often made only after the disease is present for a considerable period of time. Second, the lymphatic drainage of the stomach is so complex and so inextricably mixed with tissues which cannot be sacrificed that satisfactory block removal of the lymphatics which may contain metastases is technically impossible. Third, the extensions of the carcinoma within the wall of the stomach and into the duodenum and esophagus are much more frequent and extensive than is realized by most surgeons, and in general are more widespread than in lesions of the colon.

Extensions of cancer of the stomach may occur by a number of routes: (1) By the extramural lymphatics, (2) by direct extension to neighboring structures, e.g., liver, colon, mesocolon, and pancreas, (3) by extension via the blood stream, (4) by trans-coelomic transplantation, (5) by extension to the duodenum and esophagus through intramural lymphatics. Most of these methods of extension are well known and have been adequately recognized and described.[1, 2, 4, 6] The extensions in the wall of the stomach and into the duodenum and esophagus have been less emphasized than the others, probably because they are less evident, at least so far as gross appearance is concerned.

My interest in this problem began some years ago, and with the help of a number of my colleagues, an attempt was made to study the intramural extensions. A preliminary report on 47 operative cases was presented at the 1949 meeting of the American Surgical Association, and was subsequently published.[7] The series has since been expanded to a total of 101 cases including autopsy as well as operative specimens. The present report is concerned with the findings in this expanded series.

As described previously, the operative specimens were obtained by the pathologist in the operating room immediately after removal so they could be studied promptly. Each specimen was opened and, after gross examination, was photographed in black and white and in color. It was then pinned out on cardboard to minimize shrinkage and immersed in formalin solution. After fixation, a

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Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

sketch of the specimen was made, indicating on it the position or site at which microscopic examination was to be made. Giant sections were taken through the entire lesion and through the adjoining stomach, duodenum, or esophagus to the edge of the specimen. In a number of instances one block sufficed to reach from one end of the specimen to the other; sometimes two or more were necessary. The chief limitation to the size of the block were the dimensions of the slide and cover-slip, the measurements of which were approximately 3 x 5 inches. The tissue was imbedded in paraffin, cut on a special microtome usually at 10 micra thickness, and stained with hematoxylin and eosin.

Autopsy material was obtained by aspiration of the gastric contents with a large calibre needle and syringe through the chest wall as soon as possible after death and permission for necropsy examination had been granted. After aspiration, formalin was injected into the stomach to fix the mucosa before postmortem degeneration had occurred. At necropsy the entire stomach with a segment of duodenum and esophagus was removed, opened, pinned out on cardboard and immersed in formalin solution. Thereafter it was treated just as were the operative specimens.

It was necessary to exclude some of the operative specimens because no microscopically recognizable duodenum or esophagus was present. Some of the necropsy specimens were discarded because of inadequate fixation or digestive degeneration of the gastric mucosa. However, 101 specimens were regarded as suitable for study, divided as follows: operative 60, necropsy 41. The primary purpose of the investigation was to determine the frequency of occurrence of microscopic invasion of the duodenum and esophagus by cancer of the stomach, the extent of this invasion, and the channels by which it occurred. Examination of the sections, however, also permitted a determination of the degree of extension in the wall of the stomach itself. The extensions to be described and illustrated are usually recognizable by microscopic examination only, and cannot be determined by palpation or by inspection of either the mucosal or serosal surfaces, or indeed by gross inspection of the cut gastric wall

Microscopic extension was found to vary through wide limits. In many specimens, no microscopic extension could be demonstrated beyond the obvious

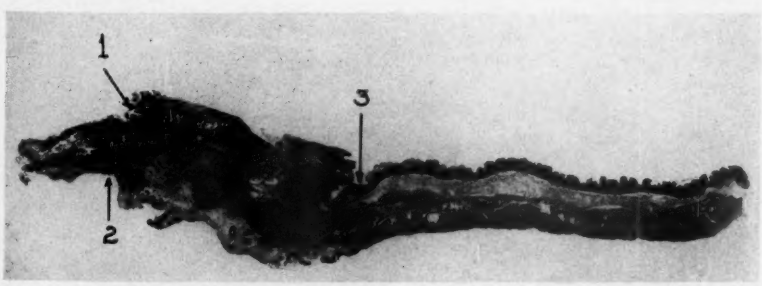

FIG. 1. Carcinoma of antrum. 1. Junction of gastric and duodenal mucosa. 2. & 3. Microscopic extension of cancer cells in wall of stomach and into duodenum.

gross limits of the tumor. In other instances, extension occurred for as much as 6 cm. from the apparent gross limits. In the stomach itself, when such long extensions were present they were principally in the submucosa, and obviously occurred in the submucous lymphatics, since the tumor cells could be seen in the lumina of lymphatics (figs. 4, 5). The extensions which occurred in the muscularis could not be seen in lymphatics in most instances. This type of extension is seen in linitis plastica, and is frequently recognized or suspected because of thickening and induration of the gastric wall and is therefore not as difficult to discover as the submucous extensions. Extensions in or just beneath the

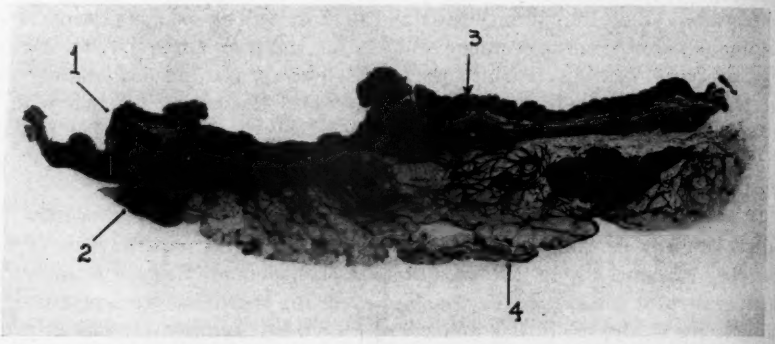

FIG. 2. Ulcerative carcinoma of antrum. 1. Junction of gastric and duodenal mucosa. 3. Submucous extension of cancer cells. 2. & 4. Microscopic extension of cancer cells in subserous areas.

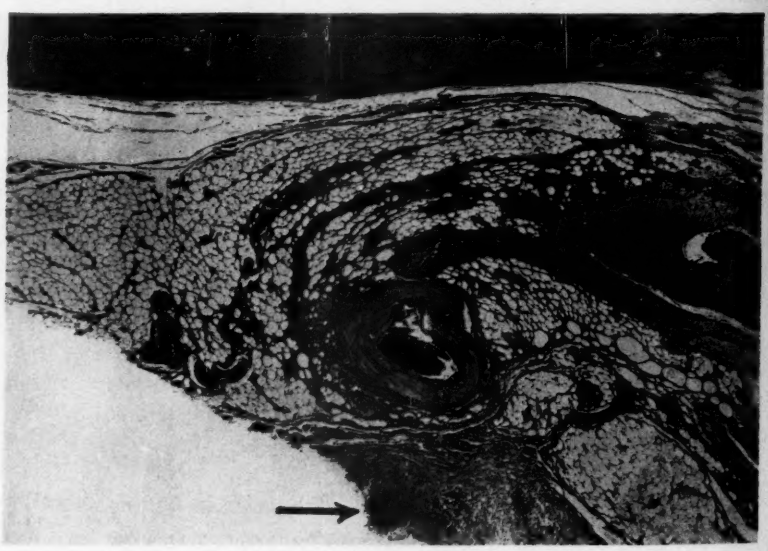

FIG. 3. Higher power (× 160) of area 2 in figure 2. Arrows point to microscopic clumps of cancer cells some of which lie in lymphatics.

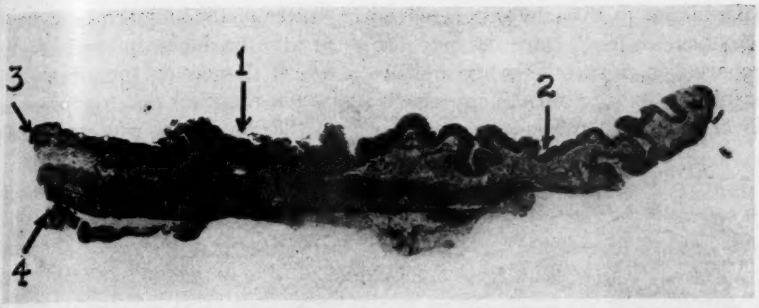

FIG. 4. Carcinoma of cardia. 1. Approximate level of diaphragm. 2. Extension of cancer cells in submucous lymphatics. 3. & 4. Extension into esophagus in submucous lymphatics and in muscularis. (Zinninger and Collins, Extension of carcinoma of the stomach into the Duodenum and Esophagus, Ann. Surg., Sept. 1949.)

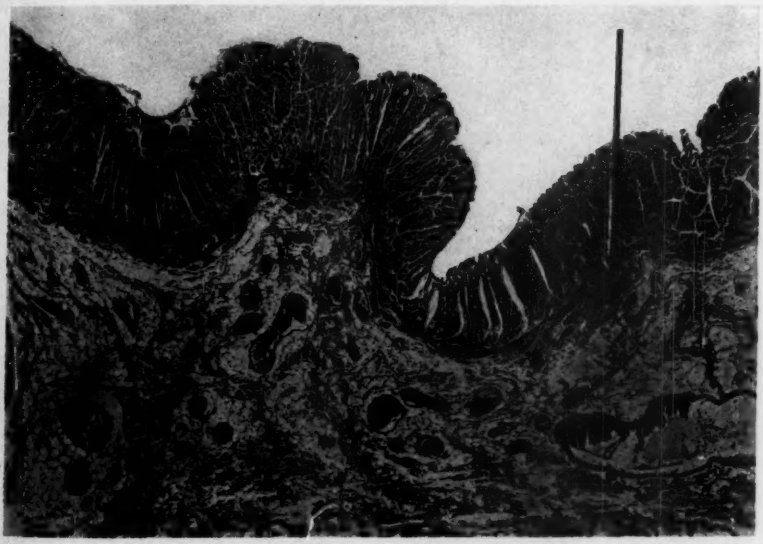

FIG. 5. Higher power (× 160) of area 2 in figure 4. Arrow points to cancer cells in submucous lymphatics in stomach. (Zinninger and Collins, Extension of carcinoma of the stomach into the Duodenum and Esophagus. Ann. Surg., Sept., 1949.)

serosa, like the submucous type, may be recognizable only microscopically and usually in the lymphatics (fig. 3). Although these were seen in some cases to extend several centimeters from the gross edge of the tumor, in general they were less widespread than the submucous extensions.

In summary, microscopic extension of cancer of the stomach may be minimal, or extensive. It may occur over wide areas principally through the intramural lymphatics in submucosal, intramuscular or subserosal layers. It is of greatest extent in the submucosa and subserosa, although it is least conspicuous in these areas (fig. 5).

In addition to the microscopic spread of cancer of the stomach in the wall of the stomach itself, extension may also occur into the duodenum and into the esophagus. In practically every instance in which this occurs the extension is recognizable only by microscopic study and is not apparent on gross examination or palpation. When spread occurs into the duodenum it is principally

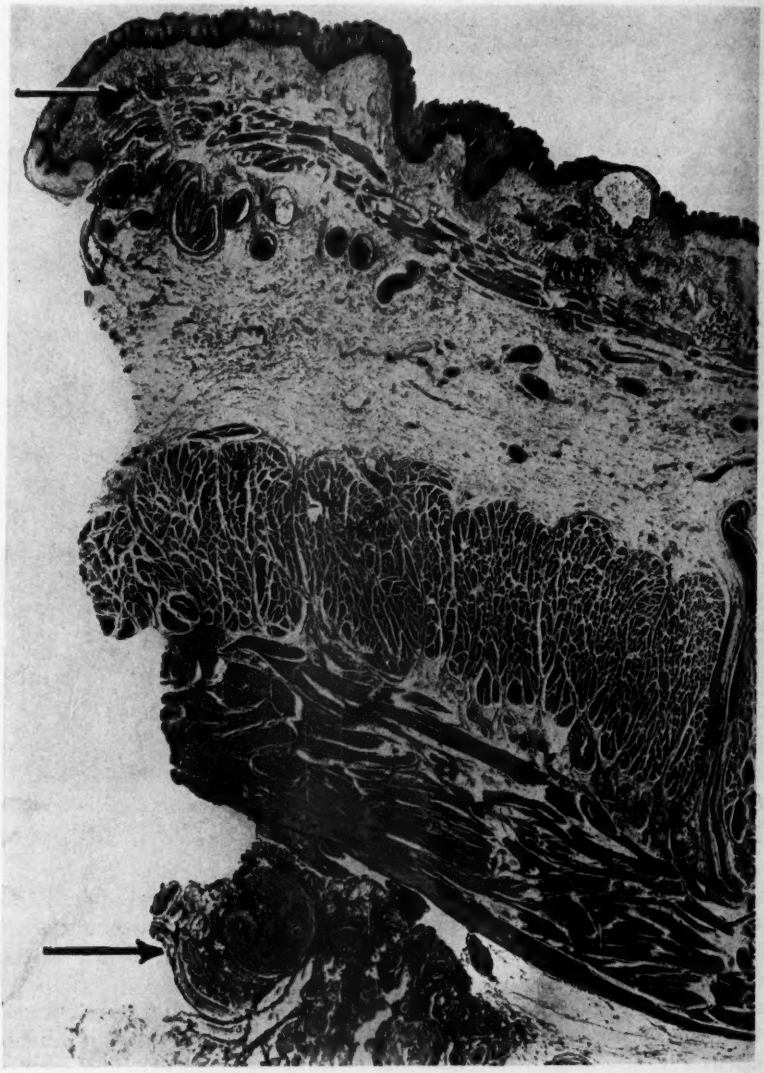

FIG. 6. Higher power (× 160) of area 3 & 4 in figure 4. Arrows point to cancer cells in submucous lymphatics and in muscularis. (Zinninger and Collins, Extension of carcinoma of the stomach into the Duodenum and Esophagus. Ann. Surg., Sept., 1949.)

through the muscular layer by direct infiltration and through the subserosal lymphatics, but is generally not of great extent. Spread into the esophagus, on the other hand, may occur in any of the layers, but seems to advance chiefly in the submucosal lymphatics (fig. 6). Following the pattern of the submucosal extension in the stomach it may be of considerable extent, i.e., 3–4 cm.

The 101 cases in this series have been divided into three broad groups depending upon the general location of the tumor in the stomach, i.e., antrum, fundus, cardia. In the accompanying charts can be seen the numbers in each location, together with the incidence of extension into the duodenum and esophagus. With the exception of a few total gastrectomies, the operative specimens were subtotal resections and showed stomach and duodenum only, or stomach and esophagus only. In such subtotal resections showing stomach with a segment of duodenum, it cannot be positively stated that no extension was present into the esophagus. However, it was assumed to be the case when the portion of the stomach proximal to the tumor showed that infiltration with cancer cells apparently ceased a significant distance from the end of the specimen.

TABLE I

Prepyloric or antral	51 cases
Limited to stomach	19 (37%)
Extension to duodenum	32 (63%)
Extension to esophagus	0 (0%)

TABLE II

Fundal	39 cases
Limited to stomach	25 (64%)
Extension to duodenum	11 (28%)
Extension to esophagus	3 (8%)

TABLE III

Prepyloric or antral	51 cases
Fundal	39 cases
	90 cases
Limited to stomach	44 (48.8%)
Extension to duodenum	43 (47.7%)
Extension to esophagus	3 (3.3%)

TABLE IV

Cardiac	11 cases
Limited to stomach	5 (45%)
Extension to duodenum	0 (0%)
Extension to esophagus	6 (55%)

TABLE V

Total cases	101 cases
Limited to stomach	49 (48%)
Extension to duodenum	43 (43%)
Extension to esophagus	9 (9%)

Extension into the duodenum while quite frequent in cancers lying in the antrum or fundus, was often of minor importance. For example, of the 43 instances in which it was shown to have occurred, it was just through the sphincter in 18. In the remaining 25, however, it was of significant extent, being up to 0.5 cm. in 10, 0.6–3.0 cm. in 12, and more than 3.0 cm. in 3.

The extent of esophageal invasion, on the other hand, was likely to be considerable. Of the 9 cases showing extension it measured 2.0 cm. in 5, 2.0–3.0 cm. in 3, and more than 3.0 cm. in 1.

In this series it was impossible to find any correlation between the gross findings and the likelihood of microscopic extension which would be of value to the surgeon at the operating table in helping him determine how wide his resection should be. The implications, however, seem to be clear. In removing any cancer of the stomach in the antrum or in the fundus in the pyloric half of the stomach, it would seem to be important to remove not only the pylorus, but also as long a segment of duodenum as can be safely and readily obtained. For cancers of the cardiac half of the stomach, it would seem to be important to remove not less than 3 cm. of the esophagus. The amount or extent of proximal stomach to be removed in performing subtotal gastrectomy for cancer in the pyloric half of the stomach is not clear. Perhaps frozen section examination of the end or ends of the resected specimen should be carried out in all patients as soon as the specimen is removed, and before anastomosis is done.

Using some of the same material and the same methods Collins and Gall[3] found that 38 per cent of the specimens showed a pleomorphic pattern with regional distribution of such nature as to suggest a coalescence of neighboring independent tumors. In 26 of 117 stomachs examined, multiple independent neoplastic lesions were detected. Four of these were recognized grossly, the remainder being microscopic in size and preinvasive in character. As a result of their studies they believe that cancer of the stomach may often be multicentric in origin. This concept means that cancer of the stomach does not necessarily arise only in one locus from a single abnormal cell or group of cells, but implies that multiple areas or perhaps the whole mucosa is altered in such a fashion that one or more cancers may arise from it, simultaneously or successively. If this concept is correct, it would seem to follow that in removing cancer of the stomach surgically, it would be desirable to remove more than just the obvious tumor, but also wide areas of mucosa beyond it. Possibly the entire mucosal area should be excised by total gastrectomy, because of the possibility that the cancerogenic changes which have occurred in one area of the gastric mucosa and produced carcinoma there, may also be operative in other remaining areas of mucosa but are not yet fully developed.

This raises the question whether or not total gastrectomy should be used routinely as the operation for cure of gastric cancer. Although the mortality rate for this operation has been lowered until it is very little higher than that for subtotal resection, the number of five year cures does not seem to be significantly greater following total than subtotal removal. Feeding difficulties following total gastrectomy are often so great that it may well be that the opera-

tion is scarcely justified except in those cases in which it seems that the obvious gross evidences of disease cannot be removed by any less extensive procedure. The impression obtained by this and other studies indicates that the biologic nature of the individual cancer is of more importance in attaining a cure than is the extensiveness of the operation. Certain cancers of the stomach are essentially local tumors with relatively little tendency to invade or infiltrate and these are the ones that are most likely to be cured by the usual methods of radical but subtotal resection. Others are invasive and infiltrative from their inception and are unlikely to be cured even by the most heroic efforts.[5] Regardless of widening of the operative excision in such cases some unrecognized but microscopic outflow of the tumor is left behind, which leads ultimately to failure to cure the patient. This may seem to be a fatalistic approach to the problem, but many published reports of long range results seem to support the view that cancer of the stomach is at times apparently cured by relatively conservative operative removal, while in others it is not cured in spite of very extensive procedures.

SUMMARY AND CONCLUSIONS

Microscopic extension of cancer cells has been shown to occur in the wall of the stomach for considerable distances (up to 6 cm.) from the apparent gross limits of the tumor. Similar extensions also occur into the duodenum and esophagus with high frequency. For cancers lying in the distal half of the stomach, the frequency of invasion of the duodenum approaches 50 per cent. Most of these extensions are recognizable only by microscopic examination and occur principally in the intramural lymphatics. These findings indicate the need for wide local removal of tissues in operations for gastric cancer.

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CARDIAC RESUSCITATION FOLLOWING STANDSTILL, VENTRICULAR FIBRILLATION AND CORONARY AIR EMBOLISM*

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It is obvious that cessation of cardiac activity constitutes one of the gravest and most urgent situations for which remedial measures may be indicated. After 180 seconds of total failure of the circulation, there is great danger of irreversible changes in the brain. After 300 seconds, these changes are practically inevitable. The efficacy of intelligent treatment now is well established by the numerous reports of successful cardiac resuscitation.[1, 25] In order to achieve these results, the surgeon must have the best possible understanding of the mechanisms involved in the cessation of the circulation and a definite plan of action must have been formulated before the emergency.

Cardiac standstill is the condition most likely to account for the sudden disappearance of the pulse during anesthesia in a person with a normal heart. Ventricular fibrillation is more frequent when cardiac disease is present. Under certain circumstances, one condition may change over into the other. Fortunately, rather specific measures are available for each of the conditions in spite of the multiplicity of etiologic factors. However, special maneuvers are necessary when the cause of the arrest of the heart is air in the coronary arteries.

Since prevention is better than cure, there has been great interest in discovering the causative factors in cardiac arrest. The studies have been of two types, animal experimentation and analyses of series of human cases. Examples of the former are the studies of Sloan[17] and Stewart, Virtue and Swan.[19] In both investigations, it was found that the inhibiting effect on the heart of vagal stimulation was enhanced by the conditions which arise when there is inadequate respiratory function, namely, hypoxia and carbon dioxide accumulation. However, one fact stood out rather plainly: it is virtually impossible to reproduce in the dog the condition of sudden and permanent cardiac standstill such as is encountered in clinical cases, unless the oxygen supply to the coronary arteries is cut off in some manner. We[13] planned some experiments to see if it might not be preferable deliberately to stop the heart before certain intracardiac operations under vena caval occlusion and found that it was hard to stop the heart. Vagal stimulation and over-etherization were ineffective. The method we finally adopted was the injection of potassium chloride into the left ventricle with the aorta clamped so that the drug entered the coronary arteries.

Recent clinical analyses include the study of 1200 collected cases of cardiac arrest by Stephenson, Reid and Hinton[19] and the report of 66 cases in children

* From the Division of General Surgery of the Henry Ford Hospital, Detroit, Michigan. Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

by Snyder, Snyder and Chaffin.[18] The series compiled by Stephenson and associates was obtained by questionnaires to a large number of surgeons in this country and five foreign countries. It is of interest that 86 per cent of the accidents reported occurred in the operating room, hence anesthesia becomes the great common denominator. Thirty-two per cent of the arrests were during abdominal operations, 17 per cent in thoracic procedures (excluding cardiac), and 14 per cent were in heart cases. The authors believed that a vagal reflex could be incriminated in 156 of 624 cases in which adequate data were available. In spite of this rather meager evidence against the vagus nerve, the same authors[8] published in this journal the statement that "sudden cardiac arrest is nearly always preventable by atropine." For further emphasis, the article was concluded as follows: "In summary, one can say that cardiac arrest is a surgical emergency in which time is of the essence. Action is imperative. However, regardless of how successful or spectacular the most ingenious and technically perfect surgical precedures have been or may be, surely it must be a sobering thought to realize that *that particular emergency was preventable* and preventable by such an old safe and reliable therapeutic agent as atropine, the very simplicity of which has contributed to its surprising and inexcusable neglect."

This opinion is difficult to reconcile with the observations of Morton and associates.[15] During operations for nonresectable carcinoma of the lung, the vagus nerve was stimulated electrically and no cardiac disturbances other than a few extrasystoles could be produced.

The cases of cardiac arrest in children collected by Snyder and coworkers[18] included 8 from the records of the Massachusetts General Hospital (1923–34) and 58 from the Los Angeles Childrens Hospital. Thirty-five of the latter were in children operated upon for congenital anomalies of the heart and great vessels. In their analysis of the etiologic factors, the authors indicated in a table that the vagus reflex was operative in 50 cases and anoxia was present in 46 cases. Obviously, since there were only 66 patients, both factors were thought to be present in many cases. The reasons for blaming the vagus nerve were not stated. This paper, which was read at the 1952 meeting of the Western Surgical Association, was discussed by Willis J. Potts as follows: "The term 'cardiac arrest' has too often been used as a term to explain operating room deaths, many of which are due to specific causes. A diagnosis of cardiac arrest, I believe, should be reserved for those patients, who for no demonstrable reason, very suddenly have cessation of cardiac activity.

"A patient who, because of unexpected cerebral hemorrhage or coronary thrombosis dies during an operation, does not die of cardiac arrest. The anesthetized patient in whom the air passage becomes obstructed, dies of suffocation or drowning, not of cardiac arrest. The child that is extremely cyanotic because of pulmonary stenosis and whose pulse goes down and down until it stops, dies of anoxia, not of cardiac arrest. The patient who gets too much of an anesthetic agent is poisoned and eventually the heart stops.

"After all sudden operating room deaths which are due to demonstrable causes are eliminated, there are a number left unaccounted for, and most of

these deaths, I believe, are the result of an inadequate exchange of gases or too much anesthetic agent or a combination of the two.

"A healthy child at play or an adult with a normal heart does not suddenly drop dead of cardiac arrest. A normal heart fed by a sufficient stream of well oxygenated blood and not poisoned by excessive drugs will not stop during any reasonable operation."

In concluding this magnificent critique of the subject of cardiac arrest, Dr. Potts concluded by stating that in an experience of approximately 750 chest operations in children, most of whom had congenital heart disease, there was but one questionable case of cardiac arrest and that occurred during a transventricular operation on a very cyanotic child with pure pulmonary stenosis. The implications for the use of *oxygen* as a prophylactic against cardiac standstill are obvious.

Dinsmore's discussion[6] of the paper by Johnson and Kirby[9] at the 1951 meeting of the American Surgical Association contains many words of wisdom with regard to the entity called cardiac arrest. He was strong in his belief that anesthetic agents and methods could be blamed.

DIAGNOSIS AND TREATMENT OF CARDIAC STANDSTILL

If during anesthesia and certain other situations it is suddenly determined that the patient has no outward evidence of cardiac activity, i.e., absent peripheral pulse, particularly in the carotid and femoral arteries, and no heart sounds, it may be assumed that cardiac activity has ceased. One is then justified in opening the chest to inspect the heart and to restore the circulation temporarily by cardiac massage. If the factor which induced the arrest has been removed, there is reasonable expectation that a spontaneous beat will be resumed. In all likelihood, the factor responsible will have been either too little oxygen or too much anesthetic agent. Therefore, during cardiac massage, the lungs must be artificially ventilated with pure oxygen, preferably by intratracheal tube. In the absence of apparatus for intratracheal respiration, ordinary mask methods may be used, and mouth-to-mouth insufflation might conceivably be life-saving when no type of apparatus is available. The optimum rate for manual systole was studied by Johnson and Kirby.[10] They found that the faster the heart was massaged, the greater the cardiac output, but the faster rates could not be maintained without fatigue of the operator. Slower rates which can be maintained by one operator continuously will provide enough blood to the brain to prevent damage.

Measures short of the dramatic operation of cardiac massage have been recommended recently. Björk[3] of Stockholm believes that the older method of injecting adrenalin into the heart still has possibilities. He recommends the injection of 1 cc. of adrenalin, 1:1000, through a wide bore needle into the heart. If there is not immediate heart action, he injects 5 cc. through the needle which has been left in place in the heart. He states that this dose is usually sufficient. If no pulse is palpable after one minute, 10 cc. are injected. He does not state what action is to be taken if this large dose fails to restore the heartbeat. A

writer in the New England Journal of Medicine (Cronkhite[4]) thought that stimulation with the needle without the injection of a drug offered good possibilities. He presented one successful case. In another issue of the same journal, Zoll[22] recommended the use of external electrical stimulation and reported 2 cases in which the heartbeat was restored. One patient, however, died from tamponade produced by needle punctures from the previous injection of adrenalin. It would appear that if this method has a place, it would be in patients with the condition of heart block with repeated attacks of asystole.

Another method which is intriguing because of its simplicity is that utilized by Roberts, Schnabel and Ravdin[16], who reported that cardiac arrest had been corrected twice in the same patient by sharp blows on the precordium. This patient subsequently expired after additional episodes had been treated by heart massage. For persistent standstill, Kay and Blalock[11] have recommended the injection of 2–4 cc. of 10 per cent calcium chloride into the left ventricle.

DIAGNOSIS AND TREATMENT OF VENTRICULAR FIBRILLATION

Ventricular fibrillation can be diagnosed by the electrocardiogram or by direct inspection of the heart. Since cardiac output in ventricular fibrillation is nil, it is evident that the irregularity will result in a terminal event unless the diagnosis is made by inspection, with the hand ready to begin manual systole immediately. With the circulation restored, the measures to defibrillate the heart can be made more leisurely. The most dependable way of stopping ventricular fibrillation is by the use of a counter-shocking device which produces asystole, which in turn may be followed by a rhythmic beat. We have used a rather simple apparatus, made in our shop from materials costing less than $20.00. The wiring diagram is shown in figure 1. More complex apparatus includes an isolation transformer to prevent accidental shocks to the surgical team and automatic timers.[12, 14] It may be necessary to shock the heart repeatedly in order to accomplish defibrillation. After standstill has been produced, a spontaneous beat may appear or manual systole may have to be used. For persistent standstill, the other measures described above may be tried.

For the treatment of ventricular fibrillation complicating hypothermia for cardiac operations, Swan and his associates have found that potassium chloride solution is useful.[21]

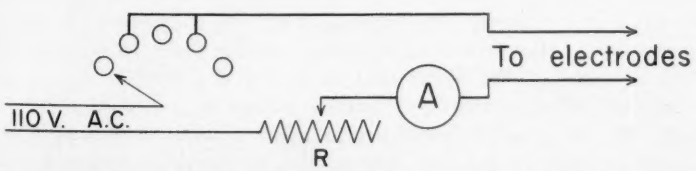

FIG. 1. Wiring diagram for a simple cardiac defibrillator. On the left is a single section Mallory rotary switch which gives two shocks when the switch is thrown rapidly in a clockwise direction. The resistance (R) is a 22 ohm Ohmite rheostat. A is a Simplex ammeter, measuring up to 5 amperes.

EXAMPLES OF CARDIAC RESUSCITATION

A review of the clinical material at the Henry Ford Hospital reveals idiopathic cardiac arrest has been rare. However, during heart operations, it has been necessary to give assistance occasionally. Naturally, there have been some deaths in the operating room which can be attributed to the anesthetic agent. No resuscitation was attempted in some of these. In others, a heartbeat was restored but the patients did not ultimately survive. Three examples of the possibilities of resuscitation are presented.

CASE REPORTS

Case 1. In a man aged 67, an attempt was being made to remove the upper lobe of a lung because of the suspicion of carcinoma with complicating infection. There was severe hemorrhage, first from the chest wall, and later from a tear in the pulmonary artery. Adequate blood replacement was not immediately available and eventually the heart stopped. Massage was begun, which produced ventricular fibrillation. About 10 minutes later, 1000 cc. of blood were given rapidly. The defibrillator was applied with immediate restoration of rhythm. The defect in the pulmonary artery was closed and the chest was closed. The blood pressure reached 100 systolic. The patient recovered many of his reflexes, but continued to bleed from multiple points in the chest and died eight hours later. This is an example of asystole from cardiac anemia.

Case 2. A child of 3 years had an intrathoracic tumor which had produced paraplegia. During the induction of anesthesia for thoracotomy, the anesthetist reported that no pulse was palpable. The heart tones were inaudible. The chest was opened and the heart was found to be motionless. After a few seconds of message, it began to beat regularly. An inoperable lesion (neurosarcoma) was biopsied. Postoperatively, the child showed decerebrate rigidity and died the next day. The interval of asystole had been too long.

Case 3. A girl of 9 years was explored with the provisional diagnosis of isolated pulmonary valvular stenosis. A long infundibular stenosis was found, and only dilatation was carried out. After the closure of the chest incision, the anesthetist reported no palpable pulse. The chest was opened and the heart was found to be in standstill. A regular beat was induced by massage. The child made an uneventful recovery.

CORONARY AIR EMBOLISM

The injection of air into the right heart (i.e., in a peripheral vein) is not lethal unless a considerable quantity is injected rapidly. On the other hand, a small quantity of air in the left heart is rapidly fatal. The dose which is uniformly fatal is 1.5 cc. per kilo. Air can gain entrance into the left heart during pneumothorax treatment (injection of air into a pulmonary vein) and in intracardiac operations. We[21] investigated the cause of death from left heart air, and found that it was due to the myocardial ischemia resulting from the bubbles of air in the coronary arteries. We found that the lesion is reversible. In the experimental animal, following the injection of an otherwise fatal dose of air into the left ventricle, the heart is permitted to reach a point of virtual standstill. Resuscitative measures are then begun. The excess air is removed from the apex of the left ventricle with a needle. The descending aorta is clamped. Forcible manual systole is then used to push the air bubbles over into the venous

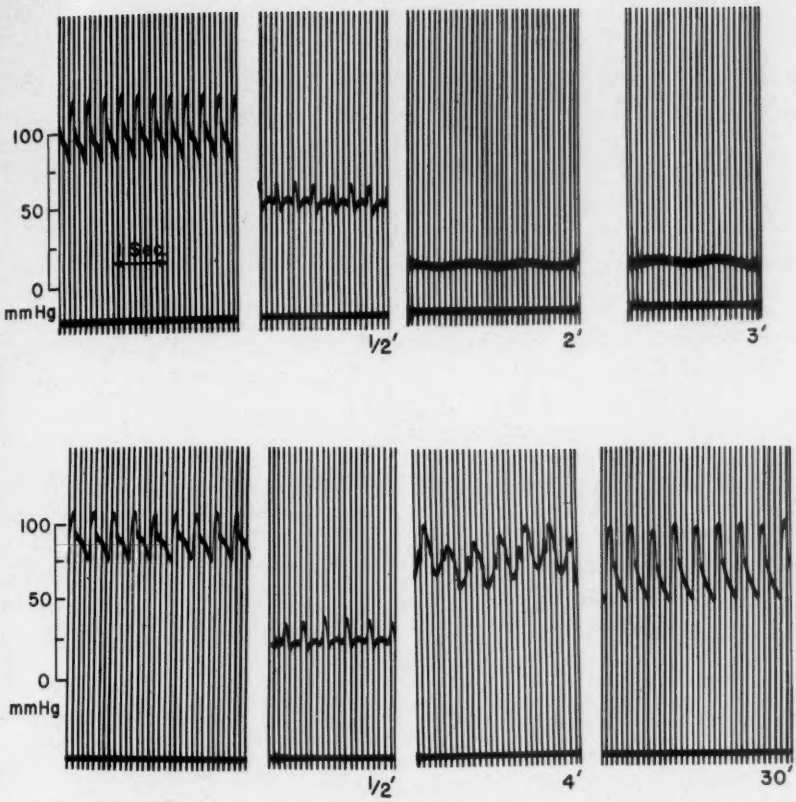

FIG. 2. Recordings of aortic pressures by Hathaway impedance gaging system. Upper row, pressures before and one-half minute, two minutes and three minutes after the injection of air into the left ventricle. Lower row, pressures in experiment to show the possibility of resuscitation. Resuscitative measures begun after one-half minute. Note excellent blood pressure after 30 minutes.

side. After a brief period of massage, a normal beat almost invariably follows, and the clamp is removed from the aorta (fig. 2). Sometimes the resuscitation is complicated by the appearance of ventricular fibrillation in which case the usual electrical defibrillation is carried out. We were able to resuscitate 17 of 20 animals by this method.

SUMMARY

Methods which have been effective in restoring heart action following standstill and ventricular fibrillation have been reviewed. Coronary air embolism can produce cardiac failure, but with appropriate maneuvers, the lesion is reversible.

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THE SURGERY OF VALVULAR HEART DISEASE*

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Although cardiac surgery is still in its infancy, great strides have been made in the last few decades. The early surgical successes were related to the pericardium and the great vessels around the heart. Only within the past few years surgical advances have been made regarding valvular deformities within the heart. Serious efforts were made toward the surgical treatment of mitral stenosis by Cutler and his associates more than a quarter of a century ago[3]; moreover a successful mitral commissurotomy was done by Souttar in 1925.[10] The operation was not generally accepted, however, until the concept of opening the fused commissures rather than cutting away a portion of the valve was popularized by Bailey[1] and Harken.[4] Since then stenosis of each of the heart valves has been subjected to surgical correction.

The mitral valve is the most frequently affected by rheumatic fever. The aortic is next and the tricuspid next. Whereas the pulmonary valve is seldom the site of rheumatic valvular disease, it is frequently stenotic on a congenital basis. The valves will be discussed separately.

MITRAL STENOSIS

The recommendation of operation to the patient with mitral stenosis is a simple problem when the patient has *pure* mitral stenosis and severe symptoms. At times, however, there are certain factors which complicate the picture.

Age in itself is no contraindication to operation, although the risk of operation, as well as of the disease, is greater in the older patient. In general the patient in his teens probably should not be operated upon unless the stenosis is severe, in order to allow the patient to get further away from the age in which rheumatic activity is most likely. It is agreed that the patient with rheumatic activity should not be operated upon.

The patient who cannot be relieved of *right heart failure* on a medical regime is a desperate surgical risk. Since operation offers the only hope for such patients, however, it is difficult to deny them that hope. Frequently such a patient is greatly improved.

One of the most difficult decisions may be with a patient who has a loud apical systolic murmur, raising the question of predominant mitral regurgitation. We have found the angiocardiogram[12] to be most helpful in assessing the relative severity of stenosis and insufficiency. In *pure* mitral stenosis the left atrium remains densely opacified for a long time, while the left ventricle is poorly opacified and small. In severe mitral regurgitation the left atrium and

* Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

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ventricle are equally opacified and the left ventricle is enlarged. Many patients with considerable mitral insufficiency have been greatly improved by the relief of some coexisting stenosis.

Disease of other valves complicating mitral stenosis is not a contraindication to operation, but increases the risk. Aortic stenosis can now be dealt with surgically at the same time. Aortic regurgitation is still a problem and the procedures being used must still be considered experimental. Tricuspid stenosis, although uncommon, must be thought of for it is apt to be overlooked at the time of operation.

Patients with mitral stenosis with minimal symptoms are usually not operated upon. However, the operation has now reached a stage in its development which permits offering it to patients with hope of considerable benefit at low risk. We therefore recommend operation to the patient with mitral stenosis causing left atrial enlargement and pulmonary congestion even though the symptoms may not yet be severe. It is difficult to see the advantage of waiting until auricular fibrillation, embolization, cardiac enlargement and congestive failure develop.

Preoperative preparation. The patient should be as free as possible of excess fluids by medical means. Time spent in this endeavor is very worthwhile. In addition to the judicious use of digitalis and mercurial diuretics, the use of resins has been found to be helpful.

Anesthesia. The choice of the anesthetic agent is probably not a matter of great importance. The most important factors seem to be to keep the patient in as light a plane of anesthesia as possible and to keep him well oxygenated.

Operative technic. The lateral approach through the fourth left interspace is preferred since it gives the best exposure in the event that a difficult auricular appendage is encountered. However, the very sick patients may develop hypotension when turned on the side. In these patients the supine position is recommended with the incision in the fourth or fifth interspace anteriorly. One or two cartilages must be divided. The anterior approach is generally recommended when aortic stenosis also is present.

A purse string suture around the auricular appendage is used with a Rumel tourniquet. The carotid arteries are occluded in the neck while the auricular appendage is opened and allowed to bleed in the hope that any clots which are present may escape. Traction sutures are placed on the edge of the auricular appendage before the finger is inserted. Finger fracture is attempted after the characteristics of the valve are evaluated. If the valve cannot be opened satisfactorily with the finger alone, a knife must be used. We believe that the anterolateral commissure should be opened out to the myocardium. At the present time the Harkens knife is most commonly used and preferred rather than the Bailey guillotine which was used for about the first half of this series. We have been more cautious about the posterior commissure. Regurgitation is more apt to be produced when it is opened. When it cannot be opened by finger fracture, and it seems desirable to open it with a knife, the Brock knife is used.

Considerable care should be taken in the closure of the auricular appendage.

If free ligatures are used, sutures should be placed behind them to prevent their slipping.

Small auricular appendage. In some instances the auricular appendage is almost completely obliterated and there is a very real danger of tearing the auricular wall as the finger is inserted. We have found the curved Potts clamp to be very helpful in clamping the side of the auricle. If the wall of the auricle is torn, it is probably best to keep the finger in the auricle to prevent bleeding while the tear is closed by suture.

Intra-auricular blood clots. When a clot is present in the auricle and does not come out when the appendage is opened, the finger must be inserted in between it and the auricular wall. We have considered this to be safer than going into the pulmonary vein. The carotid arteries are occluded in the thorax or the neck in the hope of minimizing the chance of a cerebral embolus.

Postoperative care. We do not hesitate to replace blood lost at the time of operation, but overtransfusion is a hazard. The administration of fluid during the postoperative period is carefully evaluated.

Digitalis preparations and mercurial diuretics have been useful during the postoperative period, especially when the patient was a poor risk or the valve could not be satisfactorily opened. When the valve is opened widely, the postoperative course is usually no great problem.

The low salt syndrome may result from the preoperative efforts to rid the body of excessive fluid. This becomes a problem only in the very poor-risk patient. In the average patient, the problem can be avoided by relaxing the diet once the mitral stenosis has been released.

We have used heparin starting 48 to 72 hours postoperatively in an effort to avoid postoperative emboli. Pulmonary emboli have been fairly common in the series, but appear to have been the cause of death in only 2 patients. There have been 6 major cerebral emboli at or immediately after operation. Three of these were fatal. Two instances of fatal emboli occurred after discharge from the hospital.

Results. We have operated upon 200 patients for mitral stenosis with 19 deaths. Following the initial high mortality rate when the operation was first attempted we found that the mortality rate could be governed to a considerable extent by the severity of the risk accepted for operation. With few exceptions, the fatalities have been in the very poor-risk patients.

One hundred consecutive patients in whom sufficient time has elapsed to evaluate the operation have been studied. There were six hospital deaths in this group. There have been three delayed deaths. Of the 91 patients who remain alive, 43 have had excellent results and 42 have had moderately good results, while 6 have received little if any improvement.

Efforts directed toward the correction of mitral regurgitation are still in the experimental stage.

AORTIC STENOSIS

As far as we know, the Bailey aortic dilator[7] is the best instrument at present available for opening the aortic valve. It was designed to be introduced through

the left ventricle, but also can be introduced through the aorta. It threads a beaded wire through the stenotic valve and then the instrument can be forced over the wire through the valve. The head is then opened to break open the stenotic valve.

Selection of patients. The patient with aortic stenosis, but no other valvular involvement, does not go into heart failure until quite late in the course of the disease. The experience has been that such patients are desperate surgical risks. It is believed therefore that if operation is to be offered to the patient with isolated aortic stenosis, it should be done before he reaches the end stage of the disease. Operation should be resorted to when the patient becomes incapacitated to a considerable degree by dyspnea or angina on slight exertion.

When aortic stenosis exists with mitral stenosis it should be corrected at the same time. The surgeon should feel for a systolic thrill in the aorta at each operation for mitral stenosis. When a jet of blood can be felt coming through a stenotic valve, the valve should be opened. If the thrill is of very low frequency, however, the stenosis may not be sufficiently severe to be significant.

The patient who has aortic stenosis and regurgitation is a problem. When the stenosis is the predominant lesion the valve should be dilated. When regurgitation is the predominant lesion, something more than dilatation is obviously required. To date the clinical experience is limited. The procedure most available at present is the insertion of a plastic valve in the descending aorta as suggested by Hufnagel[5].

Operative technic. Either the anterior or lateral approach may be used. A fifth interspace incision is advised in either event. For the anterior approach, the fourth and fifth costal cartilages are cut anteriorly. We have used the anterior approach most frequently. When there is both mitral and aortic stenosis, the mitral commissurotomy is done first.

A site is selected on the anterior wall of the left ventricle, relatively free of vessels, fairly close to the septum and not too close to the apex. A triangular suture is placed around this site and attached to a Rumel tourniquet. A small hole is made in the myocardium and the beaded wire inserted and passed up into the aorta. The incision in the ventricle is then enlarged and the instrument is inserted. The head is passed over the wire through the aortic valve. With the head in place as palpated through the aorta, it is opened.

Hemorrhage from the ventricle may be reduced by tightening the triangular suture. Great care must be taken not to tighten it too much for fear of its cutting through the myocardium. It is probably wise to have an arterial transfusion set up so that blood can be pumped in rapidly if necessary. As one finger is held over the wound in the myocardium, sutures are placed under it and tied. At times it has been necessary to tie the sutures over oxycel gauze to control bleeding.

Ventricular fibrillation is the greatest fear and, even when it does not occur, the heart may slow down to such an extent as to require assistance from the surgeon. Cardiac compression is apt to loosen the previously placed sutures and start bleeding again. Because of the large size of the heart, satisfactory com-

pression is difficult and greater than normal currents are required for defibrillation[6].

These problems have been so troublesome that Bailey has used the transaortic approach in some of the patients with isolated aortic stenosis, hoping to get away from irregularities of rhythm of the ventricle. If more suitable instruments can be developed it may be that his approach will be more widely used.

Results. When the aortic stenosis is associated with mitral stenosis, the chances of success are greatest. We have had only one death in this group with 15 operations. This is probably due to the fact that the left ventricle is not so hypertrophic and is less subject to arrhythmias. It also may be that with both valves involved, the aorta is not apt to be so badly diseased in order to bring the patient to operation.

The risk of operation is considerably greater when the patient has only aortic valve disease. The patient in heart failure with aortic stenosis is much closer to the end of his road than the patient in heart failure from mitral stenosis or a combination of the two. We have operated upon 10 patients with isolated aortic stenosis and 5 of them have died. Three of these 5 were in severe heart failure before operation. On the other hand, 2 of the 5 patients who survived had been in fairly severe heart failure also.

Although 2 of the patients who died were much worse risks than any who lived, nevertheless, even in retrospect it seems difficult to predict which patients might survive the operation. Those in heart failure obviously carry the greatest risk, but 2 of them survived and were greatly improved. All of the deaths were related to ventricular arrhythmias at the time of operation. When ventricular fibrillation was present the ventricles were defibrillated in all but 1 patient, but the patients later died from one cause or another.

When the valve is not calcified, but is closed by a fusion of the commissures, it is apt to be torn open along one or more fused commissures. When severe calcification is present the valve is apt to tear open without regard to commissures. Moreover, calcific emboli have apparently accounted for two of our deaths.

TRICUSPID STENOSIS

If tricuspid stenosis is diagnosed it may be opened in the same manner as is mitral stenosis. It is probably always associated with other valvular lesions. If it is suspected the diagnosis may be confirmed by palpation of a systolic thrill over the right ventricle at the time of operation. Our experience with it has been limited. Two patients died before the tricuspid stenosis was relieved as the second stage of a two stage operation upon patients with trivalvular stenosis. A third poor-risk patient died following an attempt to correct all three valves in one stage.

PULMONARY VALVULAR STENOSIS

This condition is almost always congenital in origin. It may be an isolated lesion, in which event the patient is not cyanotic, or it may be associated with

an auricular septal defect in which event cyanosis is present. Rarely it is present in the heart with the tetralogy of Fallot. The correction of this lesion by valvulotomy was first accomplished by Brock[2].

Selection of patients. With the isolated lesion the only symptoms are apt to be a decreased exercise tolerance. A systolic murmur and thrill are produced as the blood is forced through the constricted valve opening by the hypertrophied right ventricle. Cardiac catheterization will reveal a high right ventricular pressure and a low pulmonary artery pressure. The urgency of operation may be judged by the elevation of the right ventricular pressure. A systolic pressure of 75 mm. of mercury or above in the right ventricle is probably an indication for operation even though the symptoms may be mild.

The patient with pulmonary stenosis and an interauricular septal defect is cyanotic. The degree of cyanosis is apt to be proportioned to the degree of disability suffered by the patient. It is most important not to confuse such a patient with the tetralogy of Fallot for which a shunt type operation might be considered.

Technic. The insertion of a diamond shape bladed knife through the wall of the right ventricle in order to cut the pulmonary valve was suggested by Brock. Potts[9] has improved this instrument by developing a knife with retractable blades. In this fashion the hole in the ventricle may be very small. In addition a dilator with retractable blades is used. Although many patients have been operated upon with improvement by the use of these instruments, there has been considerable dissatisfaction with the completeness of the operation by such methods. For this reason Swan[11] has used direct exposure of the valve under hypothermia so as to open it widely under direct vision. We believe that visual exposure of the valve is unnecessary and that adequate correction of the valvular stenosis can be accomplished by means of the small guillotine type knife as designed by Bailey for use on the mitral valve. The knives come in pairs. The right sided knife may be inserted through a small incision in the right ventricular wall, pushed through the stenotic valve and opened. As it is withdrawn and forced toward the right, the hook on the knife engages the valve. The valve can then be cut back to its base by closing the guillotine blade. The left side of the valve may then be cut in like manner with the left sided knife. The Potts type knife is satisfactory in infants. After the age of 5 or 6 it has seemed to be too small so that we recommend the guillotine type knife.

Results. We have operated upon 15 patients with valvular pulmonary stenosis with or without an intra-auricular septal defect with no deaths. The improvement in those with an auricular septal defect was immediately apparent by the reduction in the cyanosis and the increase in the exercise tolerance. With the isolated lesion, the increase in exercise tolerance offers the chief index of improvement. When using the Potts type knife and dilator the concensus has been that the pressure in the right ventricle should be reduced by at least half. We have reason to hope that with the guillotine type knife the results will be even better.

It should be pointed out that there is considerable room for error in the diagnosis of the valvular type of pulmonary stenosis. When the pulmonary

stenosis is an isolated lesion, it is apt to be valvular in type, and the pulmonary artery will be dilated distal to the valve. Cardiac catheterization may reveal an infundibular stenosis in some instances, as well as the valvular one. The use of a catheter and manometer at the time of operation may be helpful in locating the site or sites of stenosis. Pulmonary stenosis associated with a ventricular septal defect may also present a problem in diagnosis and treatment[8].

SUMMARY

Mitral stenosis may now be attacked surgically with a risk of 5 per cent or below in the good-risk patients, whereas the over-all mortality rate may be closer to 10 per cent.

The patient who survives the operation for mitral stenosis has an 85 per cent chance of improvement with perhaps half that chance of marked improvement.

Congenital pulmonary valvular stenosis may now be operated upon with minimal risk and the hope of major improvement.

The operation for aortic stenosis and mitral stenosis combined carries a reasonable mortality rate with the hope of major improvement if regurgitation is no great problem in either valve. When the patient has only aortic stenosis the risk of operation at present is high, especially if the patient has been in severe heart failure.

The experience with tricuspid stenosis is still very limited. However, this valve may be opened by the same technic as used on mitral stenosis.

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AN EVALUATION OF THE ROLE OF VAGOTOMY IN THE TREATMENT OF DUODENAL ULCER*

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In 1952 Pollard, Bolt, Ransom and Orebaugh[6] compared the results of vagotomy and of subtotal gastrectomy in the treatment of duodenal ulcer as they were evaluated at the end of five years. In the vagotomy group, the results at the end of the second and the fifth years were identical. In the group of patients treated by solitary vagotomy 63.6 per cent were found to have satisfactory results, whereas 85.7 per cent of those who had vagotomy combined with gastroenterostomy (or pyloroplasty) had excellent or good results. In a detailed analysis of the cases with unsatisfactory results it was noted that patients who had had vagotomy only had a higher incidence both of recurrent ulcer and of severe side effects. It was estimated that in the patients treated by solitary vagotomy there was a recurrence rate of 18.2 per cent, while in the vagotomy-gastroenterostomy group the incidence of recurrence was only 4.7 per cent.

In the entire group of patients with vagal section the incidence of recurrent ulcer was 10.5 per cent. Failures in the vagotomy only group due to severe side effects, e.g. anorexia, bloating, diarrhea and gastric retention comprised 18.2 per cent. The failures in the vagotomy-gastroenterostomy group, exclusive of recurrence, were due to severe postcibal distress, episodes of nausea and vomiting, distention and the *dumping syndrome*. Only 9.8 per cent of the cases were assigned to this latter group of failures.

The present communication presents additional data concerning the use of vagotomy in the treatment of chronic duodenal ulcer and is a report of the cases of the patients who were treated by this procedure at the University of Michigan Hospital from July 1, 1947 to Dec. 31, 1951. There was a total of 83 cases in this group and the follow-up periods have ranged from two to six and one-half years. There were 61 men and 22 women and at the time of the vagus section operation, the age range was 18 to 73, the average age being 49.1 years. The cases fall into three categories; (1) vagotomy alone, 15; (2) vagotomy combined with a gastric drainage operation, 36, and (3) vagotomy combined with gastric resection, 32. There were no operative deaths in the group. Follow-up data have been obtained through out-patient department visits, letters from patients and referring physicians, questionnaires and also through the valuable assistance of the Follow-up Unit of the Social Service Department of the hospital. In 5 patients no follow-up data have been obtained, while in 4 patients the results have not been tabulated, because of death from intercurrent disease in less than two years following the operation. A minimum

* From the Department of Surgery, University of Michigan, Ann Arbor, Michigan.
Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

TABLE I

Duodenal Ulcer 1947–1951 83 Cases

Surgical Procedure	Total No. Cases	Cases Studied	Average Duration of Follow-up (Months)	Untraced	Died of Intercurrent Dis.
Vagotomy only	15	13	55	1	1
Vagotomy and drainage operation	36	33	63	1	2
Vagotomy and resection	32	28	27	3	1

TABLE II

Indications for Operation—83 Cases

Indication	No. Cases
Intractability	19
Obstruction	13
Hemorrhage	7
Intractability and Obstruction	18
Intractability and Hemorrhage	17
Obstruction and Hemorrhage	4
Intractability, Obstruction and Hemorrhage	3
Pyloric Neoplasm (?)	2

follow-up period of two years has been considered essential since in our past experience with jejunal ulcer following all types of operative procedures for duodenal ulcer, recurrence in the form of marginal ulcer occurred in less than one year in 34.6 per cent; in 58.6 per cent in less than two years, and in 76.5 per cent within five years[7]. Obviously, when dealing with duodenal ulcer a very long follow-up period is necessary before a final evaluation of results can be made. Table I gives the average duration of follow-up by groups. The indications for operation are given in table II, and are the usual ones; i.e. bleeding, obstruction and failure to respond to continued or repeated attempts at medical treatment. The indications occurred singly occasionally but much more commonly in combinations of two or even three per patient. In 2 patients in whom there was marked deformity of the duodenal bulb and the pyloric region, the diagnosis of gastric neoplasm was seriously entertained and in several other patients with high grade pyloric destruction, this diagnosis was considered and influenced the decision in favor of surgical treatment. At the time of operation a benign lesion certified by the pathologist was encountered in all patients. Table III lists the lesions for which the operations were performed.

CLINICAL DATA

In the assessment of late results, all data have been taken into account. Since many of these patients had had previous surgical treatment either in the form of emergency operation for acute perforations and/or one or more definitive procedures designed to arrest the course of the disease, and since a few have

TABLE III

Lesion for Which Operation Was Performed in 74 Cases Studied

Operative Procedure	No. Cases Studied	Primary Duodenal Ulcer	Marginal Ulcer (Posterior Gastroenterostomy)	Marginal Ulcer (Resection)
Vagotomy only	13	7	1	5
Vagotomy and drainage operation	33	33	0	0
Vagotomy and resection	28	25	2	1

required additional surgical treatment subsequent to the vagus section, the present status as judged during the follow-up year, 1953, is given with appropriate explanatory notes. We have been influenced by the suggestion of Cooper[2] that in follow-up studies concerning the treatment of peptic ulcer, the initial failure curve at times must later be revised in view of subsequent developments. Thus certain patients who experience recurrence early in their postoperative course later become improved or completely well as the result of continued medical treatment, while still others may obtain a satisfactory result through further surgical therapy. Patients have been listed as "well" if they are now free of ulcer symptoms without subjective or objective evidence of recurrence and also if they have no appreciable complaints which could be regarded as side effects of the operation; i.e., nausea, vomiting, bloating, foul eructation, postcibal distress, and diarrhea. The condition of a few patients was considered as only "improved" for a period after operation, but with the passage of time, further medical treatment or even with additional surgical interventions an entirely satisfactory result ultimately was achieved. The condition of patients on the "improved" list is definitely better than it was before operation, but they continue to have some symptoms or are required to adhere to diets or to follow more or less rigid medical regimens in order to remain symptom free. In some patients the symptoms vaguely suggest recurrence, but there is no proof of marginal ulcer or persistent or recurrent duodenal ulcer. In other patients symptoms of hypoglycemia or the dumping syndrome are present while in others the cause of their distress or complaints is not clear. It is possible that the symptoms of some of these patients may stem from other causes or unrelated diseases, but nevertheless they are included in this category. In the "unimproved" group are found a few patients who are completely unrelieved of their original complaints or if so, they have a new train of symptoms that are equally bad in their opinion so that they are no better off or are actually worse than they were before their surgical intervention. They are dissatisfied and economically are partially or totally incapacitated. Patients with recurrent ulcer belong in this group as do those with severe postgastrectomy symptoms, severe diarrhea or gastric retention with pain, nausea and vomiting. Also in this category are placed those occasional persons who suffer from severe nutritional disorders which are responsible for a state of chronic invalidism. As will be noted from the tables several of these patients have had additional surgical interventions but without success.

TABLE IV

Duodenal Ulcer 1947–1951—Late Results

Operation Procedure	Cases Studied	Well	Improved	Unimproved
Vagotomy only	13	5 (38%)	4 (31%)	4 (31%)
Vagotomy and drainage operation	33	22 (67%)	6 (18%)	5 (15%)
Vagotomy and resection	28	21 (75%)	5 (18%)	2 (7%)

TABLE V

Previous Surgical Treatment—74 Cases

Category	No. Classified	Acute Perforation with Closure		1 Definitive Operation	2 Definitive Operations
		One Episode	Two Episodes		
Vagotomy only	13		1*	4	2
Vagotomy and drainage operation	33	5	1		
Vagotomy and resection	28	2†		4	4

* This patient also had had a gastric resection.

† One patient had an acute perforation and two definitive operations (P.G.E and revision of P.G.E.).

VAGOTOMY ONLY

As will be noted in table IV, the late results have been listed for the 13 patients who were suitable for classification. In 7 the vagotomy was performed for primary duodenal ulcer, in 5 for marginal ulcer following a previous subtotal gastrectomy, and in 1 for a stomal ulcer which occurred after a posterior gastroenterostomy. Table V lists the previous surgical experiences of these patients. One had had two earlier perforations (in addition to a definitive procedure-gastrectomy). Four of the 13 had had one attempt at definitive surgery and 2 had had two such operations. In table IV are summarized the late results for the three operative procedures under consideration. Several facts stand out: (1) vagotomy alone yielded poorer results than vagotomy plus a drainage operation or vagotomy plus gastrectomy. While the initial vagus section consisted of that procedure alone, none the less, it must be remembered that of the 13 patients, 5 had already had a gastric resection and 1 a posterior gastroenterostomy so that in fact in these patients the result was due to a dual procedure. Moreover, in 3 instances subsequently additional surgical interventions were required. Hence, in the final appraisal but 5 patients had had vagus section only. One of these 5 was "well," 2 "improved," and 2 were "unimproved." Our findings are in accord with those of Weinstein and Colp[9] who found that vagotomy combined with subtotal resection was more effective in preventing gastrojejunal ulcer than was vagotomy when employed for the treatment of marginal ulcers which had followed gastric resection alone. In explanation of table VI, let it be noted that of the 5 patients listed as "well," 4 have consistently maintained a clear record without fluctuation while 1 has obtained his "well"

TABLE VI

Analysis of Late Results

Vagotomy Only—13 Cases

Well 5 (38%)	
Consistent record (2–5 years)	4
Required further surgical treatment	1
Improved 4 (31%)	
Consistent record (3–6 years)	3
Required further surgical treatment	1
Unimproved 4 (31%)	
Consistent record (3–6½ years)	3
Required further surgical treatment	1

classification only after having had a gastroenterostomy for the correction of a scar obstruction at the pylorus which was consequent upon the healing of his duodenal ulcer. In the "improved" group the records of 3 patients have remained constant. One patient soon after operation developed severe symptoms due to reactivation of his duodenal ulcer and this necessitated a subtotal resection following which he was shifted from the "unimproved" to the "improved" group. In the "unimproved" group, 3 patients have had consistently unsatisfactory ratings. One has continued to have marked gastric retention with the usual attendant symptoms, i.e., bloating, eructation, nausea, vomiting and abdominal distress. In all probability, a secondary procedure, gastroenterostomy, would correct this difficulty, but to date this man has refused further surgical therapy. In 2 patients the poor results are believed to be due to recurrent or persistent ulcer. One of these patients was originally treated for a primary duodenal ulcer and 1 for a marginal ulcer following a posterior gastroenterostomy. The fourth patient was treated originally by a solitary vagotomy for a jejunal ulcer which followed gastric resection. A few months later obstruction at the anastomosis developed. This necessitated a reresection. In spite of the fact that the gastric pouch now empties promptly and satisfactorily the patient's condition remains unimproved.

VAGOTOMY COMBINED WITH A GASTRIC DRAINAGE OPERATION

Thirty-three patients in this category have been classified. There were no follow-up data for 1 patient, and 2 had died of intercurrent disease in less than two years. All of the original lesions were primary duodenal ulcers. In 3 patients pyloroplasty was the adjunct procedure and in the remainder it was gastroenterostomy. Five patients had had closure of acute perforations previously and 1 other patient had had two acute perforation episodes. No attempts at definitive surgical treatment were recorded for any of these patients. Table IV presents the late results, the average duration of the follow-up being over five years. Twenty-two patients or two-thirds of the group, were considered to be well. In 20 of these the status had remained unchanged since operation. One other patient had been rated as only "improved" for the first year but there-

TABLE VII

Analysis of Late Results

Vagotomy Combined with a Gastric Drainage Operation—33 Cases

Well 22 (67%)	
Consistent record (4–6 years)	20
"Improved" for 1 year—now "well"	1
Required further surgical treatment	1
Improved 6 (18%)	
Consistent record (4–5 years)	4
"Unimproved" for 3 years—now "improved"	1
Required further surgical treatment	1
Unimproved 5 (15%)	
Consistent record (4 mos.–6½ years)	2
"Improved" 4 years—now "unimproved"	1
Required further surgical treatment	2

after was transferred to the "well" group. One man developed unmistakable evidence of a marginal ulcer one and one-half years following operation. Because conservative measures failed to give relief, a subtotal resection was done two years following the original procedure. He has remained well since that time. In the "improved" group are listed 6 patients. Four of these had had no change in status for the four to five years during which they have been followed. One patient remained in the "unimproved" group for three years because of persistent troublesome and disabling diarrhea with concomitant weakness and debility although ulcer symptoms were absent. These symptoms have finally subsided and he has now been shifted to the "improved" column. The remaining patient in this group, a man aged 58, had a most trying recovery period, and for many months he remained in the "unimproved" category. Following operation he at once developed a stomal ulcer and because of the intensity of symptoms a subtotal resection was performed two months later. Perforation of the original duodenal ulcer had by this time resulted in common duct obstruction and this required several additional surgical interventions and was responsible for a prolonged convalescence. His condition is now stabilized and he readily qualifies for the "improved" group. Five patients, at the time of the last follow-up examination, were regarded as "unimproved." Two have consistently maintained a poor record. One of these is considered to have a bad result due to persistent and incapacitating diarrhea even though the ulcer symptoms are in abeyance, and 1 obtained probably the worse result in our entire vagotomy series. Following the original laparotomy with vagotomy and gastroenterostomy, this 33 year old widow had no relief of her symptoms. Because there was some doubt regarding the completeness of the vagotomy, a bilateral transthoracic vagotomy was performed in order to be as certain as possible that all of the vagal fibers had been severed. This was ineffective. She continued to have pain and bleeding and died four months later. An autopsy revealed an unhealed duodenal ulcer as well as a marginal ulcer. This ulcer had perforated into the transverse colon with the formation of a gastrojejunocolic fistula. Another patient was classified

as "improved" for four years after operation. His symptoms have now returned and an anastomotic ulcer is suspected and hence his position in the tabulation has been dropped to the "unimproved" group. Two patients have required further surgical treatment. One a man aged 35 experienced an acute perforation of a jejunal ulcer one year after operation and this required emergency surgical closure. He has remained "unimproved." The other patient developed left upper quadrant pain and a mass in the left upper quadrant appeared sometime after operation. Nearly one year later a second laparotomy was performed. The mass was found to be inflammatory in nature and was thought to represent a small leak at the gastroenterostomy or possibly to have resulted from a subacute perforation of his original duodenal ulcer. He is improving slowly and probably his standing in the classification soon can be raised.

VAGOTOMY COMBINED WITH GASTRIC RESECTION

In this category are 28 cases which were suitable for evaluation. Three patients were lost to follow-up and there was one death from intercurrent disease before the expiration of the minimum follow-up period of two years. Twenty-five patients had vagotomy plus gastric resection for primary duodenal ulcer, 2 had vagotomy combined with resection for stomal ulcers following gastroenterostomy which had been performed for an original duodenal ulcer, and 1 had a reresection of the stomach combined with vagotomy for a stomal ulcer which followed an earlier seemingly adequate gastric resection. Four patients had had one previous definitive operation and 4 had had two earlier definitive procedures. Two patients had had previous acute perforations while 1 of these had had two definitive procedures subsequent to the closure of the perforation. The remote results of treatment are given in table IV. It will be noted that 75 per cent were considered "well," and 18 per cent "improved." Thus satisfactory results were obtained in 93 per cent of the cases. In only 2, or 7 per cent, was the late result considered to be poor. The 21 patients considered to be "well" have maintained a constant clear record since operation. The same is true for 4 of the 5 in the "improved" group. Two of these patients have numerous financial and marital worries and in addition, overwork and fatigue seem to be important factors. They are difficult to evaluate accurately. The

TABLE VIII

Analysis of Late Results

Vagotomy Combined with Gastric Resection—28 Cases

Well 21 (75%)	
Consistent record (2–5 years)	21
Improved 5 (18%)	
Consistent record (2 years)	4
"Unimproved" for 1 year—now "improved"	1
Unimproved 2 (7%)	
Consistent record (2 years)	1
Required further surgical treatment	1

remaining patient in this "improved" group was thought to have a marginal ulcer at the time of the first six month follow-up examination. Roentgen evidence was strongly suggestive but not definitely positive. Accordingly she was classified as "unimproved" at that time. However, her symptoms have now subsided, she is better in all respects, and accordingly has been advanced to the "improved" group. In the "unimproved" group are 2 patients. The condition of 1 who had a reresection plus vagotomy for a marginal ulcer following gastric resection, has remained poor since operation. Her complaints are chiefly pain. At times there is some evidence of gastric retention possibly on the basis of a poorly functioning stoma. There is also the possibility that she has intermittent partial small bowel obstruction. The second patient was treated originally by us by vagotomy and subtotal gastrectomy for a primary duodenal ulcer. There was prompt recurrence of symptoms and four months later a reresection was performed. Marked hypertrophic gastritis was encountered and there was suggestive evidence of a small leak at the original anastomosis. This patient continues to have pain, nausea and vomiting and must still be considered as "unimproved."

SUMMARY

Reference to table IV will show that vagotomy alone, as the term is used in this paper, gave the lowest percentage of satisfactory results (69 per cent), while vagotomy plus gastric resection yielded the highest percentage of acceptable results, (93 per cent). Vagotomy combined with a gastric drainage operation occupied an intermediate position with 85 per cent of the patients in the "well" or "improved" groups. Even with the liberal interpretation of the term vagotomy alone as used in this paper, this operative procedure seems to have a very limited field of usefulness. In our opinion, it should never be employed in the treatment of primary duodenal ulcer. In certain instances of stomal ulcer, following gastroenterostomy occurring in patients who are poor risks because of obesity or serious constitutional disease, it may be useful. The transthoracic route is recommended providing the anastomosis has been proved to be satisfactory and patent by roentgen studies. The same may be said concerning those patients with marginal ulcers following gastroenterostomy, which are in a phase of very marked activity. In such cases there is often a large inflammatory mass with severe reaction in all of the surrounding tissues making resection a difficult and hazardous procedure. Vagotomy alone seems to have its chief field of usefulness in patients who already have had an adequate gastric resection and who have developed a stomal ulcer. In such patients, it would seem that the neural phase of gastric secretion is at fault and alteration by vagus section seems to be a logical approach. Unless it is certain that the original resection was adequate, with the removal of approximately 75 per cent of the stomach, including all of the antrum, laparotomy with subdiaphragmatic vagotomy is usually indicated in order that these facts may be determined. We have on occasion considered it wise to reopen the duodenal stump and secure tissue for microscopic examination in order to demonstrate the thoroughness of the antral excision. Roentgen studies may give inaccurate evidence regarding the amount

of stomach that was originally resected. If there is no doubt regarding the adequacy of the original resection, and if the stoma is patent, vagotomy by the transthoracic route is usually simpler and easier than by the abdominal approach.

With regard to vagotomy plus gastroenterostomy, our data indicate that in the present state of our knowledge it is a good procedure for primary duodenal ulcers. More time for follow-up evaluation of very large numbers of patients will be required before final assessment can be made. According to our most recent data, the percentage of failures is higher than that reported by many authors for subtotal resection alone. However, to balance this fact is the practically negligible operative mortality and the universal applicability regardless of the status of the ulcer or the condition of the proximal duodenum. Moreover as Crile[3] has stated, the patient who is well is entirely well. The nutritional and physiologic disorders sometimes associated with subtotal gastrectomy are absent. While we do not recommend its use routinely, we believe that for patients who are substandard risks for an operation of the magnitude of subtotal gastrectomy, vagotomy combined with gastroenterostomy provides a desirable and useful alternative. Moreover, if severe inflammatory reaction, subacute perforation or proximity of the common duct would make closure of the duodenal stump difficult following a gastric resection, or would result in an insecure closure, vagotomy plus gastroenterostomy should be accepted as the best procedure even though it may be regarded as a compromise. We now prefer it to Bancroft's[1] method of exenteration of the antral mucosa prior to closure of the distal segment of the stomach when Finsterer's resection for exclusion is employed. We also prefer it to McKittrick's[5] suggestion of a planned two-stage subtotal gastrectomy i.e., first performing the Finsterer exclusion operation and six weeks later when inflammatory reaction around the pylorus has presumably subsided, resecting the antral segment.

With regard to vagotomy combined with gastric resection results thus far have been very encouraging. This is in accord with the report of Weinstein,[10] who in a series of 155 resections combined with vagotomy, observed no recurrent ulcers. Moreover, Farmer and Smithwick[4] reported 23 cases of hemigastrectomy combined with vagotomy with no operative deaths. Their patients were followed from one to five years with the following results: excellent 12, good 7, fair 3 and poor 1. The one poor result was due to intestinal obstruction and not to recurrent ulcer. These authors emphasized the desirability of decreasing the extent of the gastric resection and believed that with the protection of the added vagotomy this would not result in a high recurrence rate. Rienhoff[8] in 1945 advocated a 50 per cent resection because of its safety and comparative efficacy. His operative mortality rate was only 2 per cent, but there was a 9 per cent incidence of stomal ulcer. Both authors suggested that hemigastrectomy is safer than subtotal gastrectomy while Farmer and Smithwick contended that many of the objectionable features of subtotal gastrectomy, e.g., the dumping syndrome and the nutritional problems, weight loss, weakness and anemia can be eliminated or substantially reduced by limiting the resection to 50 per cent. In the resection cases herein reported an attempt was made to reduce the extent

of the resection. Most of these patients, as well as it is possible to estimate, had a 50 to 65 per cent resection. This principle is of great importance and we intend to explore its possibilities further.

CONCLUSIONS

Vagotomy alone is mainly of historic interest and its chief field of usefulness lies in the treatment of marginal ulcers which follow an adequate gastric resection. The transthoracic route is the preferable approach. Second, in marginal ulcers following gastroenterostomy, if there is an intense inflammatory reaction in the area, e.g. subacute perforation, making gastric resection difficult or dangerous solitary vagotomy is a useful alternative.

Vagotomy with gastroenterostomy is a good operation for duodenal ulcer, but final assessment of its worth cannot yet be made. It is not the best procedure, but it is definitely indicated for poor-risk patients or in patients in whom at operation local pathologic changes are found which would prevent a secure closure of the duodenal stump if resection were to be undertaken. It is superior to the Bancroft or McKittrick maneuvers.

Gastric resection with vagotomy appears to be superior to any other procedure now in use, i.e. considerably better than gastroenterostomy with vagotomy and better than subtotal gastrectomy alone. Further experience may indicate that a smaller resection than heretofore has been believed possible, if assisted by the protection of vagus nerve section, may be performed. Thereby, some of the objectionable features of high subtotal resection may be eliminated.

We believe that by the judicious use of the two procedures, i.e., limited gastric resection with vagotomy in suitable patients and resort to gastroenterostomy and vagotomy in patients in whom difficulty is anticipated, one may secure a high percentage of satisfactory results with an agreeably low operative mortality rate.

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PRIMARY CARCINOMA OF THE STOMACH*

REVIEW OF ONE HUNDRED AND EIGHTY SURGICAL CASES

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During the past 22 years we have observed 218 private patients with primary carcinoma of the stomach. This is a ratio of approximately 1 to every 210 patients, which is only slightly lower than the ratio reported by Berkson and associates[1] (1:200) and considerably higher than that reported by Ochsner and Blalock[11] (1:588). Not included in the count of 218 were 7 patients with gastric malignancies of other types, examined during the same period.

Of these 218 patients, 180, or 80 per cent, were operated upon. For comparative purposes, the 218 patients have been divided into two groups: those observed during the first 11 years of the review (Jan. 1, 1932 to Jan. 1, 1943), and those seen during the second 11 years (Jan. 1, 1943 to Jan. 1, 1954). The first group comprised 61 patients, of whom 46 (75 per cent) were operated upon. In the later group there were 157 patients, of whom 134 (85 per cent) had some type of operation.

Of the entire 180 who had operations, 101 were treated by resection, 81 of these having a subtotal and 20 a total gastrectomy. Twenty had a gastroenterostomy and 59 an exploration. As will be seen in table I, the resectability of those who were explored was 56 per cent in both groups. During the past five years our resectability rate has shown some increase; the significant point is, however, that in our experience these patients are not being seen any earlier today than they were 15 years ago. In addition, we are now doing resections for lesions formerly considered inoperable.

Guiss[6] estimates that the resectability rate of all patients treated in hospitals, with and without surgery, is probably about 10 per cent, and that about 20 per cent of all persons with gastric neoplasms are never admitted to hospitals. To add to this dismal picture, it should be borne in mind that by far the majority of resections are palliative rather than curative.

The mortality rate of gastrectomy has materially improved in recent years. Prior to 1940, the hospital mortality rate was, on the whole, 25 per cent or more. Today, a rate of less than 5 per cent is not unusual. Our own hospital mortality rate following resection has been reduced from 11.5 per cent during the period between 1932 and 1943, to 6.6 per cent from 1943 to 1954. During the past five years our operative mortality rate has been zero (table II).

The reported five year survival rate following gastrectomy for carcinoma, both with and without metastases, varies considerably. Lawton and associates[9] quote a five year survival rate of 16 per cent, while Ochsner and Blalock[11] report a rate of 38.9 per cent. Our five year survival rate is 18.5 per cent.

* Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

TABLE I

Operations in 180 Cases of Primary Carcinoma of the Stomach

	Exploration	Palliative	Resection
1/1/32 to 1/1/43 (46 operations)	14	6	26 (56%)
1/1/43 to 1/1/54 (134 operations)	45	14	75 (56%)
Totals	59	20	101 (56%)

TABLE II

Mortality Rate following 101 Gastric Resections for Primary Carcinoma

	Mortality Rate
1/1/32 to 1/1/43 (26 resections)	3 (11.5%)
1/1/43 to 1/1/54 (75 resections)	5 (6.6%)
Total	8 (8.0%)

NOTE: Mortality rate for past five years, including 33 subtotal and 6 total resections, has been zero.

TABLE III

Five Year Survivals in Gastric Carcinoma, with and without Surgical Treatment

Clark	5.0%
Lawton, et al.	5.0%
State	6.6%
Welch and Allen	7.0%
Brown and Kane	7.1%
Ochsner and Blalock	10.0%
Berkson, et al.	14.0%
Sanders	5.0%

A striking difference is observed in the postresection survival rates of patients who have no metastases and of those whose disease has spread to the glands and other structures. Without metastases, five year survivals of 50 per cent or more are the rule rather than the exception. Unfortunately, only a small number are discovered before the malignant process extends to the glands. The average five year survival rate of all patients observed, both those who receive surgical treatment and those who receive none, appears to be 7 or 8 per cent (table III). These figures speak for themselves.

Undoubtedly, the little progress made in the end results has been brought about chiefly within the past 10 years through more radical operations, which include lesions in the cardia, rather than through earlier diagnoses. Perhaps new methods of diagnosis which will be practicable on a mass basis will be developed; like measures already available, however, their value will be limited unless we are capable of detecting even the smallest asymptomatic cancers. For

the present, the insidious onset and lack of a positive clinical syndrome remain the paramount obstacles to cure of the disease.

SYMPTOMS

The initial symptoms of gastric carcinoma differ according to the location of the lesion and the extent to which the motor mechanism of the stomach is disturbed. Lesions at the cardia manifest themselves first by dysphagia and regurgitation and, on the whole, are discovered earlier than those in other portions of the stomach. Malignancies of the pylorus usually make themselves known by obstructive symptoms, i.e., a sense of epigastric fullness and distress after meals, and by loss of appetite and weight. Those in the greater curvature tend to remain silent until the disease is well advanced, although at times the history may reveal a loss of appetite and nausea at a fairly early stage. Lesions on the lesser curvature may be exhibited fairly early by discomfort and pain. We have observed, however, that pain associated with gastric cancer in other areas usually means the growth has extended to adjacent organs.

As the disease progresses, the clinical picture includes a definite loss of appetite, weight and strength, a more pronounced distress, nausea and vomiting, and disturbed bowel function. Anemia of some degree is associated, and melena and hematemesis are frequently reported. At this stage, pain may be the predominant symptom. In some patients, the pain is more pronounced an hour or so after meals, but is unrelieved by food, as is true of gastric ulcer. As LaDue and associates[7] point out, if the lesion is in the cardia, the pain may simulate that of angina pectoris, being referred to the chest, precordium and base of the neck, and occasionally radiating down the left arm.

Since our chief problem is the detection of early cancer of the stomach, it would seem that some progress, at least, might be gained if every physician were to make a routine practice of questioning every patient, whether or not they have complaints referable to the digestive system, regarding any symptoms or signs suggesting cancer. Particularly is this true of patients over 35 years of age. A searching inquiry may occasionally reveal disturbances which have been so slight as to have passed practically unnoticed by the patient, yet have a profound meaning to the physician.

In obtaining the history of patients who present gastrointestinal symptoms, three points should give clues to the diagnosis. The first is a history of loss of appetite and weight. Although not peculiar to cancer of the stomach, both should at once bring to mind the possibility of a malignancy of the gastrointestinal tract. Further, the more rapid the weight loss, the more likely a malignancy.

A second noteworthy feature is the duration of the symptoms. This point is at times of both diagnostic and prognostic significance. A recent onset of gastrointestinal symptoms in a previously asymptomatic individual should lead one not only to suspect a gastric cancer, but one which is highly malignant or well advanced. A number of observers have commented upon the fact that many patients with symptoms of short duration have a less favorable outlook than those whose symptoms have continued for several months or years. Lawrence

and Kay[8] found that 38 per cent of patients with inoperable gastric carcinoma had had symptoms for less than three months, as compared to 27 per cent of those who had gastrectomy. We have had a similar experience. Edwards[4] found that of 31 patients with a history of less than three months' duration, only 8 were treated by resection with a prospect of cure. Of 31 with a history of 3 to 10 years, 10 were operable.

Again, as a third clue, every patient with a gastrointestinal complaint should be questioned as to any recent change in the type or severity of the symptoms. A change in symptoms of a patient known to have chronic gastritis, gastric ulcer or any other stomach disorder is strong evidence of malignant degeneration. Many investigators are of the opinion that both gastritis and gastric ulcer are precursors of cancer, while gastric polyps are universally recognized as being precancerous. Thus, any patient with gastritis who experiences an alteration of symptoms deserves an exploration. Insofar as gastric ulcers are concerned, the distinction from malignancy is so often impossible by any method that to advise against resection where a gastric ulcer is present is a grave injustice to the patient. Starry and Dodson[14] report that 15 patients in one of their groups had been treated for periods varying from one month to three years. The diagnosis given 12 of the 15 had been gastric ulcer, even though roentgen studies had been made, and in 2 the ulcers were supposed to have healed. At operation, only 5 of the 15 lesions were resectable.

The experience of Starry and Dodson is also noteworthy with respect to the duration of treatment: 52 of 90 patients had received medical treatment for an average of 10.5 months. Gates[5] found that an average of six months had elapsed from the time of observation until a correct diagnosis was established. These and other similar reports demonstrate the need for more thorough investigation of every patient with a digestive complaint or with constitutional disturbances which might originate in nutritional disorders. If no explanation is found, a surgical exploration is indicated.

EXAMINATION

The physical examination of a patient with gastric cancer will reveal little of significance unless the disease has progressed to a stage of tumor formation and a mass is elicited on palpation. If located in the pyloric antrum or mid-portion of the stomach, the mass may be easily detected; if near the cardia, it may be impalpable even though well developed.

In view of the prevalence of anemia in association with gastric cancer, studies of the blood are an essential part of the examination. When anemia is found in combination with symptoms referable to the gastrointestinal tract, an exhaustive study is indicated. This fact should be universally recognized, yet we still see many patients with a gastrointestinal cancer who have been treated for anemia over a prolonged period, the disease meanwhile attaining incurable proportions.

Roentgen examination will demonstrate the malignancy in 90 to 95 per cent of the cases. Retention is significant, especially in the early stage of the disease. Fungating tumors are clearly visible in the film, while infiltrative growths

produce a thickening of the adjacent stomach wall and prevent its expansion. Unfortunately, when a filling defect can be demonstrated, the disease is already so far advanced as to damage seriously the mucosa and muscular wall, if it has not metastasized to remote regions.

Gastroscopy is of diagnostic value in early or doubtful cases. LaDue and co-workers[7] found that the diagnostic accuracy was increased by 9.5 per cent by the use of this method. It is especially valuable for distinguishing between cancer of the cardioesophageal junction and cardiospasm.

Gastric analysis may be made to determine the presence of achlorhydria when the roentgenogram fails to reveal a lesion. This procedure is confirmatory but not diagnostic; approximately one half of these patients have free hydrochloric acid in the stomach. Thus, the discovery of acids should be ignored when there is a cancer history and other evidence of the disease. Moreover, since the majority of elderly patients normally have low gastric acids, in this group anacidity is not necessarily significant of cancer.

If facilities permit, any question of the differential diagnosis may be settled by cytologic studies. These studies, however, require special technics and therefore are not generally available.

CRITERIA FOR OPERATION

The mortality rate of radical resection of the stomach has been so reduced that the experienced surgeon no longer fears to undertake gastrectomy, regardless of how extensive it may have to be, provided the lesion has not hopelessly metastasized. Fixed glands in the left supraclavicular area, infiltration about the umbilicus, an enlarged liver with multiple nodules, ascites and jaundice, a nodular mass on the rectal shelf, or diffuse metastases to other structures are of course contraindications to resection. The size of the growth is not the determining factor of resectability. As is well known, a large tumor of the fungating type is often easily removed and has a good prognosis, whereas a small infiltrating type of cancer is more likely to have spread to distant regions. Nor is extension of the lesion to adjacent viscera necessarily a contraindication to resection. Rather, we have found that not only the spleen, but the greater omentum, a portion of the pancreas, the adjacent colon and the left lobe of the liver, in addition to all the perigastric gland-bearing tissues, may be removed with the stomach.

Again, the location of the tumor is no longer a deterrent to resection. Fifteen years ago, removal of malignancies in the cardia and the esophageal junction was considered an impossible achievement; they now may be removed with relative impunity by total gastrectomy. Moreover, lesions in this area offer a more hopeful prognosis than those in any other portion of the stomach. In the first place, such lesions make themselves known comparatively early in their course. In the second place, they are usually of low grade malignancy and tend to remain localized longer than malignancies in the distal stomach. Pack[12] estimates that technical advances in resections of lesions at the cardia alone

have made available for cure an additional 10 per cent of all patients with gastric carcinoma.

We do not believe the age of the patient should influence one in a decision to do a resection. Advanced age is no contraindication to the procedure. Elderly individuals have a capacity for enjoying life no less than those of fewer years. Moreover, since many malignancies in elderly persons are of slow growth, it is possible that such patients will live out their normal expectancy, even though it be far beyond the usual, following radical removal of the lesion. One also should consider the fact that some of these patients are younger physiologically than chronologically, and have surprising powers of resistance and recuperation. We agree with Pack[13] that our attitude toward the treatment of elderly patients should be exactly the same as if we were called upon to remove some more acute disease, such as strangulated intestine, which might otherwise prove fatal. He reports an operation for gastric cancer upon a 92 year old physician, which was followed by cure. One of our patients was 82 and another 81 years of age.

The controversial point at present is the extent of the gastric resection for lesions in the distal portion of the stomach. There is no question that diffuse malignancies or those in the proximal end of the stomach are best treated by total gastrectomy. Some surgeons are in favor of a total gastrectomy for all gastric cancers, on the ground that recurrence of such lesions more often than not takes place in the residual stump following lesser resections. A close scrutiny of patients in whom local recurrence takes place probably would reveal that, in the majority, the resections done were not subtotal, but only partial, usually including less than half the stomach. This was true of 60 cases reviewed by McNeer and his associates[10] at the Memorial Hospital.

We agree with that group of surgeons who believe that, with the exception of those lesions in the proximal half of the stomach, which obviously demand total gastrectomy, there is no point in extirpating the entire stomach. Certainly, carcinomas involving only the distal portion do not require such a radical attack. Insofar as the lymph chains are concerned, all the perigastric glands may be removed as easily with a high subtotal gastrectomy as with the total procedure. The mortality rate of total gastrectomy is not only higher, but, of no little importance, there is usually a material difference in the postoperative well being of the patient. For all these reasons, we believe that, for localized lesions in the distal portion of the stomach, the operation which best meets the requirements of immediate safety and postoperative comfort, and at the same time gives an equal promise of survival, is one in which the resection includes the proximal portion of the duodenum and the stomach to a line well above the malignant area.

COMMENT

According to our present concept of surgery for carcinoma, each operation should be undertaken with the object of cure, as the term is at present interpreted, rather than of palliation. This applies to all cancer, no less than to carcinoma of

the stomach. It is true that resection for gastric carcinoma is essentially palliative in the presence of a few nodules in the liver or enlarged supraclavicular glands. When, however, metastases in the liver or elsewhere, or structures involved by extension of the growth can be removed, it should be our policy to do so. Here, again, the rate of growth of the lesion and the resistance of the individual are immeasurable factors, and occasionally the outcome may be surprisingly favorable. Guided by this principle, we can hardly fail to give the patient the benefit of the doubt.

In dealing with cancer, both internists and surgeons need a "*determined philosophy*", to borrow Pack's phrase. Such a philosophy applied to the treatment is already bearing results. It would no doubt be far more effective if universally applied to the detection of cancer.

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ACUTE GASTRIC DILATATION: A CLINICAL PROBLEM*

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Acute gastric dilatation, according to Prag,[5] was first recognized as early as 1833. Interest in it has been periodic since that time. It is difficult to determine the true incidence by perusal of the literature not only because of the many etiologic causes that have been assigned to it, but because it is not kept foremost in one's mind as a possible serious complication of any illness, be it surgical or medical. In the past five years, there have been 13 cases recorded at the University Hospital, and the service distribution is illustrated by table I.

This condition is known by various other names, such as acute duodenal ileus; acute gastromesenteric ileus; and arteriomesenteric ileus. Some textbooks state that the main cause of this condition is compression of the third portion of the duodenum by the superior mesenteric vessels with resultant dilatation of the proximal duodenum, and still greater dilatation of the stomach. As this mechanism persists, gas, plus the stomach and duodenal secretions, plus bile and pancreatic juices further accentuate the distension, and thus increase the embarrassment to the patient, and if unrecognized, to his doctor. While this does explain part of the picture, it does not explain the initiating force or trigger mechanism.

Novak credits Brinton (1859) with being the first to suggest that gastric paralysis results from impulses to it by way of the extrinsic nerves. Based on the work of Dragstedt[2] and his own experience with novocaine block of the celiac ganglia and vagi at the cardia, Gold[3] postulates that afferent impulses from visceral or sensory somatic nerves, which are stimulated during operation or trauma, are transmitted to the vagus center. The vagi are first stimulated only to be followed by eventual inhibition, thus producing a sort of local paralytic ileus, which is the initiating force for acute gastric dilatation.

Analysis of our patients as to age seems to indicate that the condition is more apt to occur in the upper decade. With regards to sex, the male is more often affected than the female, and the white race is more prone to have the condition than the Negro (table II).

The underlying pathology in acute gastric dilatation was varied (table III). It was secondary to lesions of the heart or lungs, or both in 8 patients; lesions of the abdomen in 3 patients; and lesions of the extremities in 2 patients.

Six of our cases were reported in autopsies, and were not diagnosed antemortem. It probably would have made little difference even if they had been diagnosed since the dilatation was secondary to an ailment fatal in itself. A seventh case was diagnosed by the roentgenogram. Of the 6 patients in whom diagnoses

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Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

TABLE 1

Service Distribution of Cases

Surgical	Medical	Obstetric	Pediatric
7	4	1	1

TABLE II

Incidence of Cases

Age						Sex		Race	
Decade						Male	Female	White	Negro
1st	2nd	3rd	6th	7th	9th				
2	2	1	2	4	2	8	5	10	3

TABLE III

Underlying Pathology in Acute Gastric Dilatation

Heart or Lung or Both	Abdominal	Surgery of Extremities
8 cases	3 cases	2 cases

were made, 5 lived, and 1 died. The death was not directly related to the dilatation because the cause of death was aspiration pneumonia.

CASE REPORTS

Case 1. D. F., an 11 month old white female was admitted to the hospital for repair of a congenital defect of the sternum. The operation was completed, and just before the dressings were applied, a roentgenogram was taken to determine whether a pneumothorax was present. While the film was being developed, the patient developed cardiac arrest, and in spite of all measures, died. Roentgenologic examination revealed evidence of marked gastric dilatation and a right pneumothorax (fig. 1). In this instance, there is a possibility that a tube in the stomach might have been helpful. This patient had an oratracheal tube in place during the operation, but it was uncuffed.

Case 2. I. H., a 65 year old white man had a ligation of the left superficial femoral artery on Sept. 25, 1950 for an aneurysm of that vessel. During the first postoperative night, he was nauseated and vomited twice. On September 26 he complained of indigestion and vomited again. A diagnosis of acute gastric dilatation was made, and a Levine tube was passed. This was done with the patient in an upright position. While the tube was being passed, the patient vomited a large quantity of bile-stained material, some of which was promptly aspirated. He became cyanotic, dyspneic, went into shock, and then lapsed into a coma. A bronchoscopy was done but respirations ceased as the scope was removed. It should be noted that shock was not present until after the vomitus had been aspirated. This patient actually drowned from his own gastric contents. This fatality might not have occurred if the patient had been in a prone position, with his head lower than his feet.

Comment. The symptomatology of acute gastric dilatation ordinarily is not specific, and a tube should be passed into the stomach at the slightest suspicion of dilatation. Gold states, "when a patient after abdominal or thoracic surgery,

FIG. 1. Case of acute gastric dilatation and right pneumothorax secondary to repair of congenital defect of sternum.

after fractures and trauma of the spine including reduction of spinal fractures, and even without being operated upon starts complaining of heart burn, belching and hiccough, a tentative diagnosis of acute gastric dilatation should be made." Diagnosis is strengthened if the patient brings up small amounts of brownish or greenish fluid. This might be considered overflow, and likened to the patient with a distended bladder who voids a few cc. of urine frequently. Of 13 patients, 8 vomited one or more times and the material brought up contained bile. In 1 of the patients, whose condition was diagnosed, symptoms were more evident.

Case 3. G. L., an 18 year old white woman was admitted to the hospital on Sept. 3, 1953 with a complaint of abdominal fullness. Her illness was of sudden onset, and started three days previously with retrosternal pain, nausea and vomiting. Positive findings were subcutaneous emphysema over the upper portion of the right chest, and a silent distended abdomen. Distention was so marked that one examiner suggested the possibility of ascites. Her blood pressure was 110/90; pulse 120–140; respiration 24; temperature 100 F.; white blood count per cu. mm. 22,850; hemoglobin 109 per cent–15.9 Gm. Urinalysis was negative except for 1 plus albumin. Urea N. 87 mg. per cent; CO_2 58 vol. per cent–26 mm.Eq. Roentgenologic examination of the chest revealed air in the soft tissues between the right scapula and the chest wall, and a large stomach bubble (fig. 2). On September 4 a Levine tube was passed and 3 liters of greenish fluid were aspirated from the stomach within one-half hour with relief of the abdominal discomfort. A second chest film on September 9 showed an increase in the air in the soft tissues (fig. 3). The final diagnosis was spontaneous mediastinal emphysema with reflex acute gastric dilatation.

Comment. Although this case was relatively acute in onset, it was of prolonged duration. Her hospital stay was 19 days, and during that time, the Levine tube was removed, and reinserted twice after the initial passage. A gastrointestinal series, made on the eighth hospital day, showed a distended atonic stomach

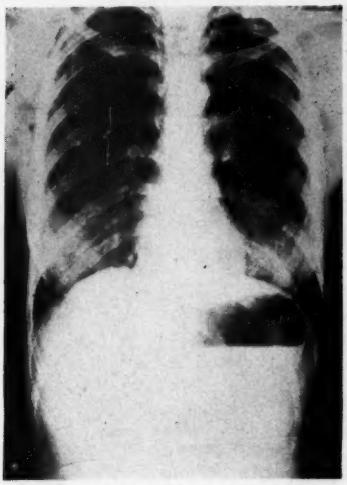

FIG. 2. Case of spontaneous mediastinal emphysema with reflex acute gastric dilatation. Air can be seen in soft tissues between right scapula and chest wall. Large stomach bubble is noted.

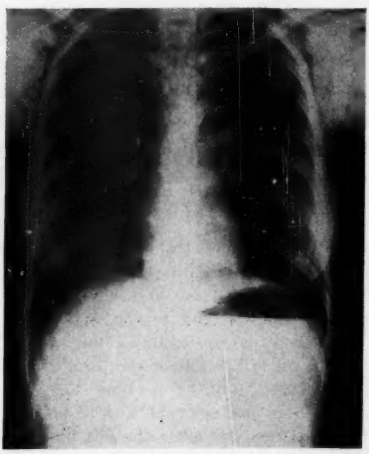

FIG. 3. Case of spontaneous mediastinal emphysema with reflex acute gastric dilatation. Note increase in air in soft tissues as compared to figure 2.

(fig. 4). A 24 hour film, which is not shown, revealed that there was 98 per cent retention of barium. A gastrointestinal series, just before discharge, was normal.

From the above case, one gets the impression that the process may be relatively slow in onset, and most cases seem to follow this pattern. The severity of symptoms seems to vary with the rapidity of onset of acute gastric dilatation—a gradual dilatation being better tolerated than a rapid one. The comparison is

FIG. 4. Gastrointestinal series showing dilated atonic stomach on the eighth hospital day of patient shown in figures 2 and 3.

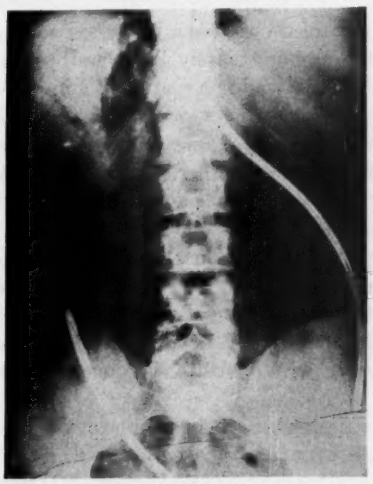

FIG. 5. Ability of stomach to dilate due to obstruction at the pylorus. Levine tube follows course of greater curvature. This patient had a Whipple operation for carcinoma of pancreas three and one-half years previously.

similar to cardiac tamponade versus a massive pericardial effusion which is gradual in its development. The ability of the stomach to dilate is shown in figure 5, where a Levine tube outlines the greater curvature of the stomach. This case is not one of acute gastric dilatation but one of actual obstruction.

When the onset of gastric dilatation is rapid, it is more apt to be accompanied

by signs of shock. In all of our cases where shock was present, the underlying pathologic condition was of such severity that shock normally would be anticipated. Acute gastric dilatation is apt to follow any shocking procedure or illness. This is suggested by the following case report.

Case 4. J. E., a 17 year old white man had an osteotomy and application of a bone plate and double hip spica for malunion of a fracture of the left femur. Shock was marked as was also acute gastric dilatation. However, it is believed that shock was the direct result of his operative procedure, not the dilatation.

DISCUSSION

In most reported cases of acute gastric dilatation following operations, it has been noted that 60 to 70 per cent of the patients have had general anesthesia. In those patients in whom it has occurred during operation, the stomach content is chiefly gas.[2] Of the 6 patients, operated upon in this series, 5 had general anesthesia, and 1 spinal. In 3, endotracheal tubes were used. This could play a part in initiating the reflex visceromotor mechanism.

With the increase in the use of sodium pentothal and curare, a patient frequently has to be *bag-breathed*, and at times, this is done without an endotracheal tube in place with the result that much of the gas is forced into the stomach. In a recent case, not included in this series, while closing the peritoneum in a low midline incision, a part of the stomach presented through the lower edge of the wound. The patient was immediately intubated, and the stomach decompressed. This near accident occurred in a matter of minutes when the anesthetist attempted to give better relaxation with an additional injection of sodium pentothal and curare. The patient became apneic and was *bag-breathed* without the insertion of an endotracheal tube. Another case not included in this series was of a 16 year old white boy who was to have an exploratory thoracotomy. However, a satisfactory induction was not obtained and the operation was postponed. Before he left the operating room, a Levine tube was passed into the stomach. Its external end was placed under water, and large amount of air or gas bubbled through the water. From these cases, and the work of Maddock,[4] it is shown air or gas is apt to enter the stomach in any anesthetized patient, especially if there is obstruction to the airway, with a resultant increase in negative pressure in the esophagus.

Therapy of acute gastric dilatation should be preventative rather than curative. It is suggested that a Levine tube be inserted into the stomach in all patients having thoracic and upper abdominal operations; in those associated with a shocking procedure or trauma; and in any patient who at sometime or other has had an obstructed airway during the course of his anesthetic. Death by drowning becomes a very real danger when acute gastric dilatation occurs.

SUMMARY

Acute gastric dilatation may complicate many different types of lesions.
Its symptomatology is frequently minimal.
Intubation should be done at the slightest suspicion of its presence.

If present, and symptoms are marked, the patient should be placed in the prone position with the head lower than the feet in order to prevent aspiration and drowning.

It is more apt to complicate a general anesthetic.

Treatment, preferably, should be preventive.

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NUTRITION IN THE ELDERLY SURGICAL PATIENT*

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Nutrition in the elderly patient is not unlike that in other age groups. There are counterparts which may be related to any period of life. Undernutrition and overnutrition both occur in geriatric patients. The latter is encountered more often and may be more difficult to correct.

There are many reasons why normal requirements are not fulfilled and maintained in the elderly. The primary features are lack of normal activity, decrease in metabolism and a retardation of most body functions, frequently in association with variations in appetite and economic pressures. The dietary deficiencies are directly related to anorexia, loss of weight, marked fatigability, asthenia, hypotension and secondary anemia. Although they may be related to secondary manifestations of normal processes, in the elderly patient they are most often directly related to organic disease. It is essential to ascertain what disturbances exist before proceeding with surgery.

Certain basic changes are expected in the digestive processes of elderly patients. Primarily, there is a general slowing of the motility of the gastrointestinal tract. This may develop as a result of decreased normal activity plus a slowing of metabolic function and a diminution of the digestive enzymes. It has been shown by Meyer, Spier and Neuwelt[6] that the fasting salivary amylase and pancreatic amylase are below normal levels in the elderly patient. The proteolytic enzymes, pepsin and trypsin, likewise decrease in quantity and are unable to compensate for each other in the digestive process. The concentration of lipase remains relatively unchanged in old age. Anacidity and subacidity are found to have no influence on the activities of the enzymes of the pancreas. These findings are of significance in determining the basic nutritional requirements and in explaining certain symptoms of abnormal nutrition.

It has been stated by Ohlson[8] that *healthy* elderly patients usually eat well balanced meals. Those with less vitality may present evidences of age in excess of normal years and show evidences of poor nutrition. It is difficult to demonstrate where the specific nutritional difficulties exist.

In order to maintain normal requirements, the diet must be high in protein, with an estimated daily minimum intake of 1 gram per kilogram of body weight. Many patients may require as much as 2 grams of proteins daily. Because protein provided in the normal manner is not always fully utilized by the elderly patient, some type of fortified amino acids may need to be administered. Due to dietary dislikes of the patient, evidences of protein deprivations are frequently seen in otherwise normal individuals. Carbohydrates in moderate quantities furnish readily available energy without depleting tissue proteins. Fats in

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moderation are indicated but excessive quantities are to be avoided for normal nutrition. The fat intake well may be limited to 15 to 25 per cent of the caloric needs. The supplementary administration of calcium, adequate vitamins—primarily riboflavin, niacinamide, brewer's yeast and ascorbic acid—is required in most elderly patients. Powdered milk, fortified with vitamins and minerals, furnishes an excellent supplemental dietary formula.

The method of Elliott and associates,[1] using a continuous intragastric tube feeding, perhaps more nearly fulfills the needs of debilitated patients. In preparation for surgery and during the postoperative period, the use of *dripolac* may in some instances offset the deficiencies.

Kountz, Hofstatter and Ackermann[4] conclude that the amino acids possess certain advantages over the regular protein foods. Some elderly patients do not like diets which include adequate quantities of meat and other proteins. A natural protein diet provides fewer calories than one containing fortified amino acid. The hydrolyzed amino acid diet seems to increase appetite, whereas the natural protein diet decreases it. It has been shown that a high protein diet, over a long period of time, raises the blood urea nitrogen. No such increase is shown, however, even after prolonged administration of amino acids. It is believed that the clinical appearance and sense of well being are more pronounced in patients given amino acids than in those on the protein diet.

Elderly patients are prone to subsist on a high carbohydrate diet which is more easily taken and furnishes sufficient energy for the other factors essential to normal nutritional equilibrium. Sooner or later any elderly patient may exhibit the effects of poor cellular nutrition along with the degenerative changes of old age.

A normal equilibrium exists between the anabolic effect of the 17-Ketosteroids (androsteroids and estrosteroids), and the catabolic effect of the 11-oxycorticosteroids. Odendaal[7] considers the 11-oxycorticosteroids predominant in old age. In the future, some effort may be made to prolong the equilibrium by means of hormones, but for the present we must depend on nutrition.

In the surgical patient obesity adds a burden beyond those encountered in the degenerative diseases. The handicap is twofold: first, the excess load creates more work for the vital organs and second, it tends to promote degenerative diseases. Moreover, it has been suggested by Keys[3] that a high fat diet may be more responsible than a high cholesterol consumption for the changes of arteriosclerosis. In any event, excess weight increases the morbidity and mortality rates of surgical patients.

It has been shown that the obese require more anesthesia than individuals of normal weight. This results either in excessive administration of the anesthetic agents for relaxation or a poorly relaxed patient. In either event, performance of the procedure is made extremely difficult. When an excess of anesthetic agents must be given the liver must work harder to detoxify and eliminate them. This may be harmful to individuals who present evidence of deficiencies or who have associated liver disease, such as obstructive jaundice. The most common complications encountered in the obese are respiratory in nature, particularly

atelectasis. Thrombosis and embolism are reported to occur more frequently in the obese than in others. For safety, a compromise procedure may be required in the obese individual.

It is not always feasible to institute a strenuous reducing program if the need for surgery is urgent, but one should be most careful in the selection of the obese patient for elective surgery.

Optimum nutrition, according to Schnabel,[9] can be maintained by adequate food intake, both quantitatively and qualitatively. The cardiovascular and lymphatic systems must distribute the product of digestion efficiently. Proper utilization prevents impairment of cellular activity and the accumulation of injurious products of metabolism. In later life, particularly in patients with associated systemic disease, faulty utilization is the rule.

The normal and abnormal findings in the aged are sometimes difficult to ascertain. Senile changes may be obvious in those whose biologic age exceeds their chronologic age. Evidences of abnormality can be determined by an accurate history, but that is not always obtainable in elderly patients. Frequently neither the patient nor his family or attendants are capable of giving concise information. The physical findings also are most valuable in establishing the true condition of the patient. A few laboratory procedures also may be of value: electrocardiographic deviations, delayed sugar tolerance curves, evidence of renal dysfunction and the findings of anemia. When abnormalities are found preoperatively efforts at correction should be made. It is mandatory that the elderly patient be more carefully evaluated than the younger individual before operation.

Fagerstrom[2] accounts for the production of protein deficiency by decreased protein intake, inability to digest and absorb these materials properly, inadequate synthesis of the plasma proteins by the liver, and excessive loss of proteins from the body. A few methods help determine the degree of protein deficiency. Nitrogen balance studies are thought to be the most accurate, but these are not always practicable. Studies of total blood volume, and of the level of blood proteins combined with the determination of albumin and globulin ratio, are of value.

During the surgical intervention, the deficiency is aggravated by the condition requiring operation. The prolonged anesthesia, the blood loss during the operation, and the immediate postoperative starvation period all intensify the deficiency. The surgeon is particularly concerned for those individuals who, following gastrointestinal surgery, are, for various reasons, unable to take an adequate oral diet. The duration of their postoperative period of starvation may be variable and difficult to correct. The manifestations of their deficiencies are increased by anorexia, weight loss, and a delay in the body defense mechanism against any associated infection. These factors may delay wound healing.

Much has been written in regard to the healing of soft tissue wounds in relation to age, nutrition, and anemia. In many reported studies the clinical evaluations are inconclusive and no definite opinions are stated. It is known that protein deficiencies interfere with the process of wound healing and that anemia

and electrolyte deficiency are perhaps also deterrent factors. However, it has never been shown that the process of aging alone disturbs the healing process in soft tissue wounds. This, however, does not apply to the healing of bone, since many other factors are involved which would inhibit the normal healing processes.

Levenson[5] makes a distinction between acute nutritional deficiencies and longstanding chronic deficiencies in the experimental animal. The acute deficiencies are of less importance and cause fewer disturbances in the process of healing than the longstanding ones. In the appraisal, therefore, a distinction must be made between them in order to correct any changes that may have occurred. The problem primarily is to determine whether one is dealing with a diseased state or with the normal processes producing the changes of senility.

From the practical standpoint, many patients who would be expected to have difficulty during surgical intervention do not manifest these changes. For this reason, indicated operations on the poor-risk patients should not be withheld.

TREATMENT

Nutritional deficiency must be corrected before instituting elective procedures. If sufficient time is available, the normal methods of administration of natural proteins, carbohydrates, and fats may suffice. Administration of protein hydrolysates by the intravenous route is practically useless, since rapid loss through the kidneys may prevent a maintained elevation of serum proteins. In a surgical emergency, evaluation and correction are not always feasible. Intragastric alimentation with fortified proteins, fats, and carbohydrates and with sufficient minerals and vitamins can be given to those individuals who are refractory to oral treatment. One of the main problems is the maintenance of fluid balance. Dehydration, which is frequently encountered, can be made worse by overadministration of fluids. This is particularly true in patients with cardiovascular disease, for whom restriction of sodium intake is even more necessary than in younger individuals. In many patients sodium should be limited to 200 mg. daily. The calcium intake should be maintained at approximately 1 gram daily. Since there is a normal tendency in elderly people for calcium depletion, this amount will result neither in deposits nor in depletion. Correction of specific nutritional disturbances must be provided according to the degree of deficiency, both quantitatively and qualitatively.

SUMMARY

The problem of nutrition of the elderly patient resembles that of any age group.

Since longevity is increasing, the number of surgical procedures required by the elderly are also increasing.

Complete evaluation of the nutritional status of each patient is necessary before emergency or elective surgery is undertaken.

It is essential to recognize the normal process of aging which produces clinical as well as laboratory evidences of nutritional deficiencies.

Laboratory findings of disturbance in the glucose metabolism, electrocardio-

graphic patterns, total blood volume, blood proteins and the blood urea nitrogen are of value in differentiating between normal and diseased states.

Enzymatic disturbances in the elderly patient may aggravate existing abnormalities. In the aged, production of most of the enzymes except lipase decreases.

The most frequent nutritional deficiency encountered is in the proteins.

A diet of approximately 2,000 calories, which is high in proteins, low in fats and carbohydrates, with sufficient vitamins and minerals to maintain the normal requirements, is the most beneficial therapy.

The administration of continuous intragastric feedings consisting of a fortified diet, high in proteins, minerals and vitamins may mean the difference between success and failure in patients requiring major surgery.

The process of wound healing has been shown to be affected by the state of the patient's nutrition. However, the healing process may be unaltered in the normal, healthy person, regardless of age.

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THE IMPORTANCE OF CORRECT PATHOLOGIC DIAGNOSIS OF CARCINOMA OF THE PROSTATE*

CLINICAL APPLICATION

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Reports from various clinics claim that from 20 to 30 per cent of the cases of hyperplasia of the prostate gland are malignant. Most of the cases are diagnosed both clinically and microscopically, while a small percentage is missed clinically but correctly diagnosed after a careful microscopic examination. The largest percentage of these cases, when clinically diagnosed, are treated as malignant cases without any type of biopsy being studied. Some cases have been diagnosed as malignant from specimens obtained by the resectoscope, while in many more the diagnosis of malignancy is missed in the resected specimens either because sufficient sections were not examined or the malignant areas were not resected. The reverse also is true that clinically a diagnosis of carcinoma is made and a perineal biopsy demonstrates no malignancy, but working on the basis that the biopsy specimen may not have included the suspicious area, a radical prostatectomy is sometimes done. Further examination of the removed specimen reveals no evidence of malignancy. This occurred in one of our cases.

The purpose of this report is to discuss the possible pitfalls of an incorrect interpretation of gross or microscopic pathology in making a diagnosis of carcinoma of the prostate.

The basis of our discussion is a study of 5 patients referred to us in one year. The purpose of the referral of each patient was to have a radical perineal prostatectomy done for carcinoma. All 5 cases had been diagnosed as malignant. Two of these 5 were diagnosed as malignant only from the rectal examination, 1 from evidence obtained from a roentgenogram of the pelvic bones, 1 from the study of tissue removed at a transurethral operation and 1 from a microscopic study of the prostatic tissue removed at a suprapubic operation.

Two of the 5 patients had had a recent prostatic operation, 1 had a bilateral orchiectomy without a recent operation on the prostate and 2 of them had not been operated upon. Unfortunately we had not received the sections for study of the 2 patients who had recent prostatic operations before our operation. The 2 patients who had not had any operation showed evidence by rectal examination that carcinoma might be present. The other 3 patients revealed no definite evidence of carcinoma by rectal examination.

It is a routine of ours that cases of suspicious or definite evidence of carcinoma of the prostate be examined by a perineal exposure so that tissue for biopsy may be taken from the suspicious area. This was suggested to all 5 patients and subsequently was done.

The outcome of the study of the biopsy specimens was interesting. The histo-

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pathologic study of the tissue of the 2 patients who had not been operated upon showed no evidence of any malignancy. We proceeded in spite of this and did a radical operation in 1 and removed only the adenomatous tissue in the other. The radical operation was done as a safety measure in case of error in the biopsy study. A study of the tissue of the second patient (the one that had bilateral orchiectomy) showed no evidence of any malignancy in spite of metastatic evidence in the pelvic bones. Therefore, a radical prostatectomy was not done. One patient who had a suprapubic prostatectomy showed no evidence of a carcinoma in the biopsy specimen so a partial prostatectomy was done on the remaining tissue. The patient who had the transurethral operation revealed no evidence of carcinoma in the biopsy specimen and a partial prostatectomy was done. In other words a diagnosis of carcinoma of the prostate was made in all 5 patients and a histopathologic study of the biopsied tissue removed at perineal exposure revealed no evidence of carcinoma.

A thorough study of the permanent sections of the prostatic tissue removed at perineal operations in all 5 patients revealed no evidence of carcinoma. We finally were able to obtain the sections of the 2 patients who had had previous operations. Interestingly enough a study of the section sent to us in the patient who had the suprapubic operation revealed no evidence of carcinoma according to our interpretation while the other patient who had a diagnosis of carcinoma made by a study of sections removed by a transurethral operation revealed a definite carcinoma of the prostate, while our sections of the biopsy or a section from the removed prostate showed no evidence of carcinoma.

One always must be mindful of the possibility of a difference in interpretation of clinical signs and in the study of microscopic sections. Two of the 5 patients were under the direction of general surgeons which may account for a difference of opinion. In 1 patient the microscopic sections were studied in a small clinic.

Is this difference of opinion of any great importance? Probably the citation of the cases will permit a better discussion. Peculiarly enough in one of the patients who was referred with a diagnosis of carcinoma grade III, the diagnosis was made from a study of the removed transurethral sections. We had not seen the sections. Our perineal biopsy showed no evidence of carcinoma, but we proceeded to do a radical operation. Our section obtained from the removed specimen showed no evidence of malignancy. Yet, when we obtained the sections of the transurethral procedure, we agreed with the diagnosis of carcinoma of the prostate. Was this patient who had carcinoma of the prostate cured by a transurethral operation? Will he remain cured even after a radical procedure was employed? We think he has an excellent opportunity of remaining cured of his carcinoma.

CASE REPORTS

Case 1. I. H. C., a 46 year old white man, was first seen by us on Nov. 19, 1951. He was referred for a radical perineal prostatectomy because of a diagnosis of carcinoma of the prostate made from the tissue removed by suprapubic prostatectomy. He had been complaining of a mild nocturia with low back pain. There was a moderate sized middle lobe enlargement. At the time of our examination eight months postoperatively—the patient did not present any urinary or other symptoms. A rectal examination revealed no enlarge-

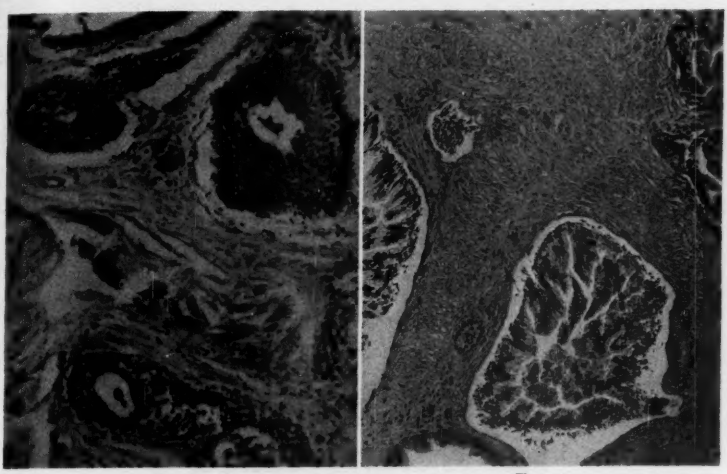

FIG. 1 FIG. 2

FIG. 1 Case 1. Section of prostate made at another institution, diagnosed as malignant. Intraductal epithelial proliferation shows no evidence of malignancy.

FIG 2 Case 1. Perineal biopsy of prostatic tissue. Picture of fibroadenomatous hyperplasia but no evidence of malignancy.

ment of prostatic tissue. There was some induration laterally—a type of induration that may present itself after a prostatectomy.

Roentgenograms revealed no evidence of any metastasis. Phosphatase studies were normal. Urine studies were negative and cystoscopic studies were entirely normal. On the strength of the microscopic section—which was not obtained by us—we decided to do a radical operation. A study of the tissue obtained by perineal biopsy showed no malignancy. Because the sections taken from the entire removed gland may have shown a carcinoma, we proceeded with only a partial radical operation. The permanent sections of the removed specimen showed "fragments of prostatic tissue demonstrating fibroadenomatous hyperplasia but no evidence of carcinoma." The patient made an uneventful recovery and was discharged from the hospital in 13 days. He could void with a good stream and had perfect control. He was last seen on Oct. 15, 1953 and was in excellent condition. Roentgenograms showed no evidence of any bony metastasis (figs. 1, 2, 3).

Case 2. S. W., aged 67, was first seen by us for his prostatic condition on Aug. 8, 1945 at which time he was complaining of mild symptoms of prostatism. Rectal examination revealed a first degree hypertrophy. Cystoscopic examination showed a small median bar causing only 20 cc. of residual urine. He was treated conservatively for two months. He returned in January 1946 with urinary symptoms more aggravated. In March 1946 a transurethral prostatic resection was done removing 8 Gm. of tissue. Microscopic report of the tissue showed fibroadenomatous hyperplasia. He obtained a satisfactory result from this procedure. Aside from some unimportant complications he progressed satisfactorily until March 1947. At that time he complained of some chest pains and cough. His sputum was examined for tubercle bacilli and found to be positive, but never were we able to recover tuberculous organisms again. His chest examination showed some tuberculous infiltration in his lungs. He was referred to his medical advisor, but no definite action was taken, except to remove his residence to California. After a short stay in California he was treated for some burning on urination. One and one-half years after the first transurethral resection he again had symptoms of prostatism and returned to Baltimore. Cystoscopic examination showed some bulging of the prostate and on Oct. 8, 1948, a second transurethral procedure

FIG. 3 Case 1. Section of removed remaining tissue demonstrates same picture as in figure 2. No malignancy.

was done removing 5 Gm. of tissue which also showed fibroadenomatous hyperplasia. A satisfactory result was obtained and he returned to California. He was not seen again for two and one-half years when he again returned to Baltimore stating that he had had a bilateral orchiectomy and was given stilbestrol and deep roentgen ray therapy for a supposedly carcinoma of the prostate. Roentgenograms of the pelvic bones were made while in California and these demonstrated evidence of metastasis from a supposedly carcinoma of the prostate. He was advised to have a radical perineal prostatectomy.

Our examination on May 28, 1951, did not show hypertrophy of the prostate, nor any evidence of any carcinoma of the gland. Cystoscopic examination showed some bulging of the prostate anteriorly. Roentgenograms of the pelvic bones showed evidence of a metastatic process. Phosphatase studies were normal. No biopsy of the prostate had been made in California prior to the orchiectomy. Because of a bilateral orchiectomy and stilbestrol administration, it was thought that the evidence of carcinoma of the prostate had disappeared. He stated that just before leaving California he coughed up blood on one occasion. It was for this reason that another roentgenogram of his chest was made and reported negative. Bronchoscopic examination was not done. As a result of our findings we suggested an open perineal biopsy section of the prostate be studied before any radical operation. He consented to this and on June 22, 1951, several portions of prostatic tissue were removed for biopsy. The report read as follows, "fragments of prostatic tissue showing areas of intraductal epithelial proliferation and squamous cell metaplasia." Since no evidence of malignancy was found no radical procedure was done.

After his discharge from the hospital, he began to complain of pain down his left thigh. He had had this symptom before and claimed that deep roentgen ray therapy relieved the pain. He was again given deep therapy but no relief was obtained. He was relieved somewhat by narcotics and continued taking stilbestrol, but after a short while, no further relief was obtained. He was advised to have an operation upon his adrenals and was admitted to the Sinai Hospital on Nov. 15, 1951. Roentgenogram of his chest did not show any evidence of metastases in the lungs. Phosphatase studies were again normal.

He was transferred to another hospital where a bilateral adrenalectomy was done. He made an uneventful recovery from the operation but suddenly died later from a supposedly heart condition. An autopsy was obtained and from this study, unusual interest was aroused

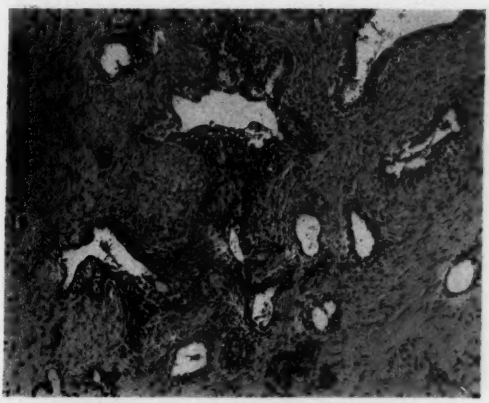

FIG. 4 Case 2. Perineal biopsy of tissue shows only areas of intraductal epithelial proliferation and no evidence of malignancy.

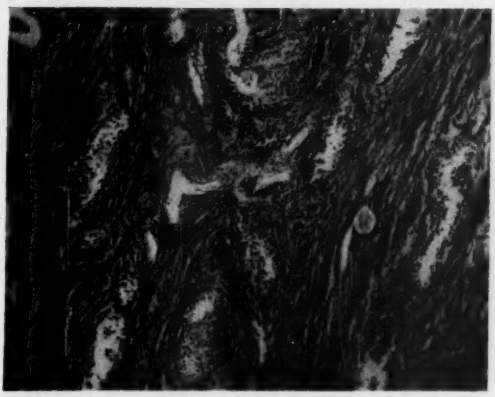

FIG. 5 Case 2. Autopsy specimen. Section through capsule and posterior lobe of the prostate showing squamous metaplasia but no evidence of carcinoma.

because of the unsuspected findings. A pathologist reported that: "The remaining portion of the prostate was removed and sectioned almost serially and no evidence of a carcinoma was found. Sections of the bony pelvis were made and these showed metastatic carcinoma, not from the prostate, but from a primary carcinoma of a bronchus. There was evidence of metastases in the pancreas, liver and other organs." A further discussion will follow (figs. 4, 5, 6).

Case 3. D. G., aged 55, was first seen on May 1, 1952. His history in brief was that he had been having symptoms of prostatism for which a transurethral prostatic resection was done. The pathologist reported an adenocarcinoma. The patient was relieved by the transurethral operation and he had no further disturbing urinary symptoms. Cystoscopic and roentgenographic examinations were negative. Rectal examination revealed no hypertrophy of the capsule nor any evidence of malignancy. Phosphatase studies were within normal limits. Because of the above story we suggested that tissue for biopsy be removed through the perineum. A histopathologic examination of the tissue removed showed no evidence of

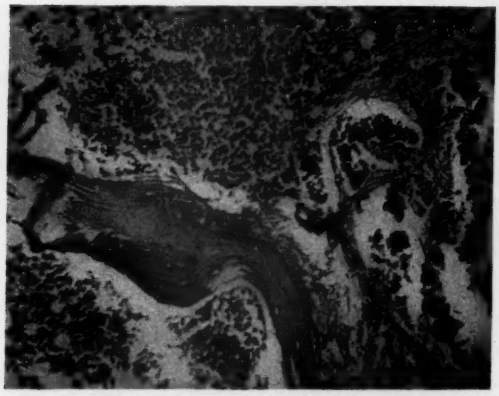

FIG. 6 Case 2. Section showing extensive metastatic carcinomatous involvement of a lumbar vertebra, secondary to a carcinoma of a bronchus.

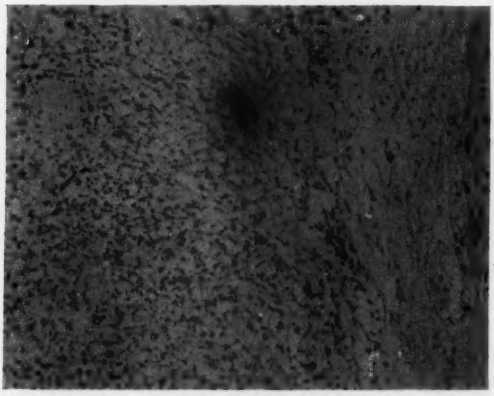

FIG. 7 Case 3. Transurethral resection from another institution, appears to be that of bladder neck of prostatic urethra and show the presence of an undifferentiated malignant neoplasm origin of which might well be in the bladder.

malignancy. Because of this, a partial prostatectomy was done. A study of the permanent sections from all the tissue removed revealed no evidence of malignancy. The report follows: "Fibroadenomatous hyperplasia of the prostate with a segment of the prostatic urethra showing leukoplakia and with squamous metaplasia being present in the adjacent ducts" (figs. 7, 8).

Case 4. O. C. K., aged 66, was first seen by us on Dec. 13, 1951. He was referred to us for an examination because of a nodule in the left lobe of his prostate and pain across his back. There was no diurnal or nocturnal frequency. Cystoscopic examination revealed large median and lateral lobes bulging into the bladder and urethra. Rectally it felt like a carcinoma of the prostate. Roentgenograms of bones were negative for metastases. There was no increase in phosphatase.

It was believed that because of the hypertrophy of the gland a prostatectomy should be done. In view of the fact that a nodule was present it was decided to do a perineal procedure so that tissue from the nodule for biopsy could be taken to determine whether a

FIG. 8 Case 3. Perineal biopsy. Section is typical of entire specimen and shows perfectly benign glands which manifest papillary invagination of their walls and are grouped in close approximation.

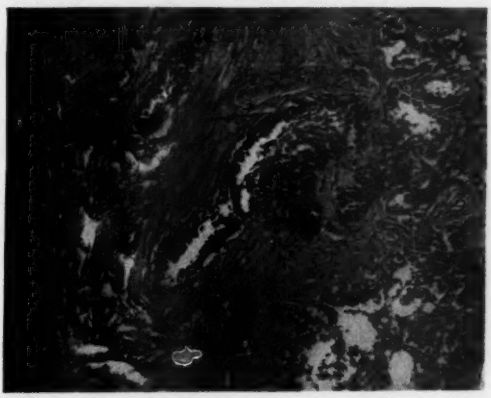

FIG. 9 Case 4. Perineal biopsy of prostatic tissue shows the typical picture of scattered glands found in the posterior lobe with some intraluminal epithelial proliferation. No evidence of malignancy.

radical operation should be done. A perineal exposure was made and a biopsy specimen was taken. It was reported to be negative for carcinoma. Since we were so definite about its being malignant, with the possibility that the frozen section might not have demonstrated the true picture, or that the biopsy specimen was not taken from the proper place, a radical operation was decided upon. It was done without any difficulty and he recovered with a temporary incontinence because of the wide resection. A careful study of sections from the entire specimen revealed no malignancy. The suspicious nodule proved to be a myoma of the prostate. The temporary incontinence, which existed for about six months, caused him to be quite uncomfortable. Later he gained complete control of urination (figs. 9, 10).

Case 5. P. P., aged 61, was first seen by us on Aug. 25, 1951. He was referred to us for a radical perineal prostatectomy because of a nodule about ½ cm. in diameter in the left lobe of the prostate. There was no diurnal or nocturnal frequency. Roentgenographic studies

FIG. 10 Case 4. Routine section of removed prostate shows picture of fibroadenomatous hyperplasia. No malignancy.

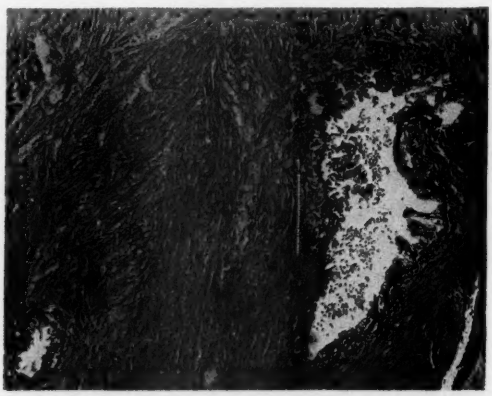

FIG. 11 Case 5. Perineal biopsy shows fibroadenomatous hyperplasia. No malignancy.

revealed no evidence of any metastases. Phosphatase studies were within normal limits. A cystoscopic examination showed some bulging posteriorly in the form of a small median lobe. Because of the above findings it was decided to do a perineal exposure to obtain tissue for biopsy of the suspicious area in preparation for a radical operation if necessary. Tissue from the nodule was obtained and several sections were examined. There was no evidence of any malignant changes in the examined sections. No further procedure was done (fig. 11).

DISCUSSION

Hinman, Jr. and Hinman[5] in 1949, reported an analysis of 59 patients with early carcinoma in each of which a diagnosis had been missed by rectal examination. In one group of 27 patients in this series, a diagnosis of carcinoma was made from the tissue obtained by transurethral resection, 9 of which were later subjected to radical perineal prostatectomies. The second group of 32 patients

operated upon, either by suprapubic or perineal approach, were diagnosed from the tissue removed at the time of operation. Only 5 of these were subjected to radical operation. In the first group of 9 there was a duration of life of 36.8 months, while in the second group of 5, there was a duration of life of 67.8 months. In their report they mention a case similar to our case 3. A transurethral resection was done on one patient and a report returned by a reliable pathologist that carcinoma of the prostate existed. A radical perineal prostatectomy was done and a study of the tissue revealed no evidence of carcinoma. This patient was still alive eight years after the operation. This report may tend to answer our questions mentioned above.

Goodwin[3] reports on 22 cases of secondary radical perineal prostatectomy for carcinoma, some of which were primarily done by transurethral resection. Of the 22 patients operated upon, 5 showed no evidence of carcinoma in the tissue removed secondarily even though definite evidence of carcinoma was present in the previous sections. This suggests again the possibility of removing an occult carcinoma at the first operation. In one of the patients a definite inflammatory condition existed in the prostate. This frequently is confusing when attempting to make a diagnosis of carcinoma of the prostate.

Semple[7] and Barnes[1] and Hinman[5] state that the difficulty of making a conclusive differential diagnosis between malignant involvement and inflammatory changes in the prostate raises the question of the reliability of the various methods of investigation. Accurate methods are of utmost importance since cancer of the prostate is said to be the commonest carcinoma in a man over the age of 60 years.

Hey[4] and Barnes believe much as we do that the only conclusive evidence of malignant involvement of the prostate gland is by microscopic examination of the tissue removed from the suspected area of the prostate by way of the perineal route. Yet, in 1 of our patients, no evidence of malignancy was obtained through the perineal biopsy procedure, but carcinoma was present in the tissue removed by transurethral resection. This was due, of course, to the fact that probably all of the carcinoma had been removed at the first operation.

Medicolegal complications may follow in cases of erroneous diagnosis of carcinoma of the prostate so that bilateral orchiectomy should not be a procedure to be done before a conclusive diagnosis of carcinoma of the prostate is made. One of our patients had this operation done and later it was proved that he did not have a carcinoma of the prostate. Great resentment existed in this patient.

Kimbrough and Rowe,[6] in a study of a series of 78 cases of carcinoma of the prostate, stated that 2 patients in whom they were very positive that carcinoma existed, proved to have benign lesions by perineal biopsy at time of operation or by later pathologic examination. They have employed the perineal biopsy in a large number of their patients, but they have found it misleading at times unless the tissue is removed from the proper area. In one of their patients the biopsy section removed all of the cancer tissue. The diagnosis was established or confirmed in 18 patients.

Barnes, Bergman and Farley[2] claim that tissue removed in a transurethral

operation for histopathologic study for cancer is of no great value if it is from near the urethra or taken at random, but is of more value for study when taken near the dorsal portion of the gland near the capsule.

In a review of these cases and a discussion of the subject one is impressed with the fact that, in the face of all our present knowledge of cancer, there is still ample room for improvement in the diagnosis and treatment of carcinoma of the prostate. Under the best of circumstances our tactile sense can be misleading, and even with more thorough examinations, such as a histopathologic study, one can be misled regardless of the care with which examinations are made. The human element of personal experience; the possibility of difference of opinion, and personal judgment enters considerably into the diagnosis and treatment of these patients. No one method of procedure will render an accurate diagnosis at all times.

CONCLUSIONS

Every possible procedure should be explored in an effort to make a correct diagnosis of carcinoma of the prostate.

All suspicious palpable prostatic nodules should have a perineal biopsy for histologic study.

A clinical diagnosis of carcinoma of the prostate always should be verified by a histopathologic diagnosis.

Several selected pieces of tissue always should be examined microscopically for carcinoma when a transurethral prostatic operation is done.

A questionable histopathologic diagnosis of carcinoma should receive further study.

Radical prostatectomies should not be done without a definite histopathologic diagnosis.

Orchiectomies should not be done without a histopathologic diagnosis of carcinoma of the prostate.

Metastasis found in the pelvic bones or lumbar vertebrae should not always be considered secondary to carcinoma of the prostate.

Adrenalectomies should not be done for carcinoma of the prostate without a definite histopathologic diagnosis.

We wish to thank the Department of Pathology of the Johns Hopkins Hospital for their courtesy in lending us the slides in case 2 in which both institutions were interested.

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THE SURGICAL TREATMENT OF PULMONARY BLASTOMYCOSIS*

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The well founded increasing popularity of exploratory thoracotomy for investigation and anticipated resection of *undiagnosed* lesions of the lung has led to the recognition of the prevalence of diseases which were once thought to be medical rarities. The fear of neglect of a possible carcinoma, and the knowledge of the pathologic irreversibility of certain infections have given impetus to this concept of modern thoracic surgery. In a period of 25 months, from March 1951 to April 1953, we encountered 4 cases of unsuspected pulmonary blastomycosis in resected specimens. The rarity of such an experience was not realized until a review of the literature revealed only 13 published cases of resection for this disease.

The purpose of this paper is twofold: the addition of 4 detailed case reports to the dearth of the present literature; and, the review of certain features of blastomycosis and its treatment which seem to demand positive preoperative diagnosis and the selectivity of treatment as analogous to pulmonary tuberculosis.

PATHOLOGY AND ALLERGY

The response of the human body to the yeast-like organism, blastomyces dermatitidis, is very similar to the response after invasion by the tubercle bacillus. In the lungs there may be diffuse or focal consolidation, miliary foci, large nodules, or even macroscopic abscesses. Pulmonary cavities are unusual and are typically small. Necrosis is less frequent than in tuberculosis and only in small focal areas.[12] The microscopic picture is one of a chronic granuloma with polymorphonuclear cells, cellular debris, and giant cells. Micro-abscesses are frequent. Blastomyces should be found among the inflammatory cells or within the giant cells for confirmation of the diagnosis. It has been stated that microscopic tissue differentiation between blastomycosis and tuberculosis is impossible without the demonstration of the fungus.[12] However, Werthammer[19] recognizes for practical purposes such histologic criteria as tubercle-like granulomata with suppuration rather than caseation, as indicating fungus infection. He proved this by making frozen section diagnoses in 2 of our 4 cases at the operating table, the fungi being demonstrated later in the permanent sections.

The monumental work of Martin and Smith[11] and Smith[17] in the study of allergic reactions and antibody response marked the first real step forward in the understanding of the varied responses of the body to the blastomycete. They discovered that "some patients develop humoral antibodies which can be detected by the complement fixation test, and others acquire a hypersensitivity to the antigen of the organism as shown by the presence of a positive skin test

* Presented during the Birmingham assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Ala.

either to a vaccine or to blastomycin". They applied this knowledge to clinical cases and found the most favorable group of patients were those with a positive skin test and a negative complement fixation. In other words, this group had excellent resistance and not enough infection to stimulate the humoral antibodies. The group with the poorest prognosis, negative skin tests and positive complement fixation, were those with terminal anergy and overwhelming infection. These patients are analogous to those dying with generalized tuberculosis. One further clinical application of this work lies in their advice to desensitize a patient with a highly positive skin test before administering potassium iodide because of the great danger of dissemination of the disease. Therein lies one other possible analogy to tuberculosis.

The patient's symptoms and roentgenographic findings also give information as to the phase of the disease. Abundant sputum and a febrile course obviously indicate a more active infection than that manifested by a silent mass in the lung. Even without consideration of the skin test and complement fixation, the clinically active infection is more likely to disseminate, especially with surgical trauma.

DIAGNOSIS

The diagnosis can be unequivocally established only by the positive identification of the organism, Blastomyces dermatitidis. Isolation of the fungus by both smear and culture of sputum is not difficult by trained laboratory personnel, and the relatively few positive reports from the laboratory stem jointly from the infrequency of the disease, the infrequency of requests for this study, and the lackadaisical attitude of some technicians in most hospital laboratories toward the identification of any fungus. Bronchoscopy is an invaluable aid as proposed by Weisel and Landis.[18] They found frequent small ulcerations in the bronchial tree and a tan or brownish secretion in 7 patients. A biopsy specimen from a granuloma was positive in 1 case, and organisms were demonstrated in bronchial secretions in 3 more. In one of the authors' cases, blastomycetes were found in a saline irrigation specimen obtained for cell study by the Papanicolaou technic. A skin test showing a delayed tuberculin-like reaction, and a positive complement fixation are both highly significant. The skin test is very easy to do and the blastomycin antigen is readily available. However, the complement fixation test may be beyond the scope of the average laboratory. Tissue biopsy, even without demonstration of the organism is highly suspicious, and with positive identification, is conclusive. Little has been said in the literature thus far about the identification of blastomycetes in the urine, but Bonoff[2] reported 23 cases of acute blastomycosis in an epidemic among United States troops on Okinawa in 1946. Six of these patients had pulmonary lesions and the fungus was isolated "in either the sputum or urine, and sometimes in both". Biopsy of the *scalene* lymph node or needle biopsy of the liver, particularly in febrile patients, may give the correct diagnosis.

With such positive means to establish the diagnosis of blastomycosis, it remains for the diagnostician to be forever alert as to the possibility, however

uncommon the disease. The two tragedies in the following 4 case reports might have been avoided had the authors had such foresight.

TREATMENT

Potassium iodide and blastomycin have long been a poor acme in the therapy of blastomycosis, although it has been refreshing to read of the many patients cured by the diligent, painstaking administration of these agents.[5, 10, 11, 17, 18] However, modern trends demand a *specific* which all of the antibiotics and sulfonamides have yet failed to provide. Hopkins and Murphy[9] have reported the treatment of a single case of disseminated blastomycosis with undecylenic acid with good results. Schoenbach[15, 16] and others[1, 4, 6, 13, 14] have reported apparent cures of the disease with stilbamidine, one of the aromatic diamidines. This last chemotherapeutic drug seems to offer the best antifungal properties thus far. Toxicity has forced abandonment of several other promising agents. Even stilbamidine has a most distressing incidence of fifth nerve neuropathy with 70 or more per cent of patients incurring some impairment of this cranial nerve. From unpublished data, it is our understanding that generalized neuropathies have occurred, and 1 instance of severe toxic psychosis has been reported.[7] Two-hydroxy-stilbamidine has now been used experimentally with excellent results and relatively little neurotoxic effects even in much larger doses.

The analogy of the problem of the treatment of blastomycosis to that of tuberculosis is well sponsored by Buechner and associates.[3] A pathologic process producing irreversible changes such as necrosis, abscess formation, granulomata, and other possible permanent pathologic changes, such as bronchiectasis, must be considered as an indication for surgical ablation at the *proper* time. The selection of this time must be ascertained after a careful survey of resistance factors, character of roentgenographic changes and condition of the patient; and, after preoperative preparation with stilbamidine, or the future drug of choice.

REVIEW OF PREVIOUS CASES OF BLASTOMYCOSIS WITH RESECTION OF LUNG

Chart number 1 gives a detailed analysis of the previously published cases, with the 4 presented in this article. It is interesting to note that only 2 of the 17 cases were diagnosed correctly preoperatively, both of these by sputum examinations. Five of the patients died within 11 months following surgery, the only 2 correct preoperative diagnoses being among the 5. Carcinoma was the tentative diagnosis in 8 of the 12 cases where an opinion was expressed preoperatively.

CASE REPORTS

Case 1

History. W. H. a 60 year old white railroad engineer, from central West Virginia, was admitted to St. Mary's Hospital on March 21, 1951. He was apparently perfectly well until two months before admission. He then developed a nonproductive cough, wheezing, and left anterior pleuritic pain. Mild fever was present. A chest roentgenogram by his local physician revealed a "virus infection" in the left upper lobe (fig. 1). Successive courses of penicillin, aureomycin, and chloromycetin were given without improvement. Three days

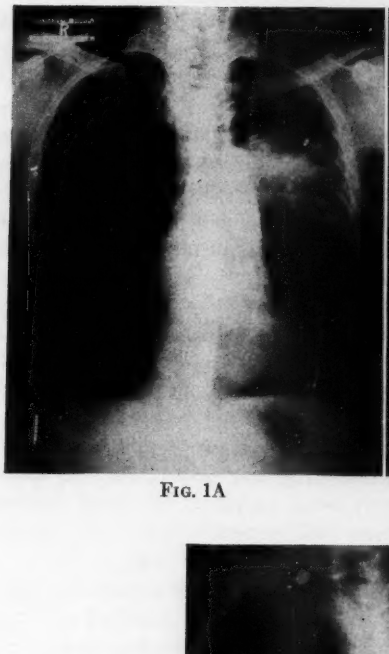

FIG. 1A

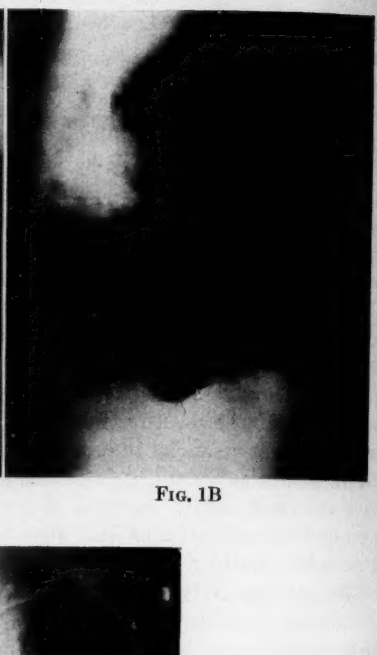

FIG. 1B

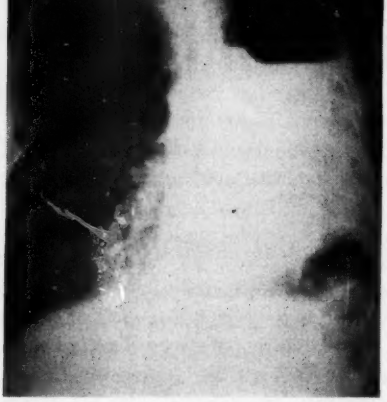

FIG. 1C

FIG. 1, Case 1. A. & B. Showing carcinoma-like shadow in left lung. C. A film on the third postoperative day shows a spread of infection in right cardiophrenic angle.

prior to admission his cough became productive of moderate quantities of clear, white sputum, and his fever rose intermittently to 103 F. There were no hemoptyses, but mild dyspnea began. Weakness had been progressive, and in the two months since onset, he had lost 13 pounds in weight.

Physical Examination. Examination revealed an acutely ill, febrile man of stated age. His temperature was 101 F. and his pulse rate was 90. Small soft nodes were palpated in the left axilla and in the cervical and supraclavicular regions. There was pronounced wheez-

CHART 1.

CHART 1.

This chart gives the available data of the previously reported cases of pulmonary resection for pulmonary blastomycosis. Blank spaces indicate lack of information. Chart includes authors' 4 cases.

Case No.	Year of Surgery	Author	Age Color Sex	Preoperative Diagnosis	Skin Test	Complement Fixation	Organisms Demonstrated	Resected Specimen	Postoperative Dissemination	Postoperative Fungicidal Treatment	Result
1.	1943	Smith (17)		Carcinoma	Neg.	Neg.	Tissue, resected specimen	R.U.L.	Residual disease, same lung	Potassium Iodide	Died, 9 months
2.	1947	Smith (17)	F.	Carcinoma	Neg.	Neg.	Tissue, resected specimen	Lung	Rib and skin	Potassium Iodide	Well, 1 year
3.	1947	Smith (17)			Neg.	Neg.	Tissue, resected specimen	Lobe			
4.	1947	Smith (17)			Neg.	Neg.	Tissue, resected specimen	Lobe			
5.	1947	Feld (5) and Cudden	30 W. M.	Blastomycosis	Neg.	Neg.	Sputum, smear and culture (preop.); Tissue, resected specimen	R.U.L.	Generalized, left lung and skin		Died, 11 months
6.	1949	Weisel (18) and Landis	56 W. M.	Tuberculosis	Neg.		Tissue, resected specimen	R.U.L.			Well
7.	1950	Hopkins (9) and Murphy	34 C. M.	Blastomycosis	Neg.	Neg.	Sputum, smear and culture (preop.); Tissue, resected specimen	Right lung	Generalized	Potassium Iodide	Died, 6 months
8.	1950	Weisel (18) and Landis	27 W. M.	Chronic suppuration			Tissue, resected specimen; Nasal lesion (postop.)	R.L.L. R.M.L.			Well, 1 year
9.	1951	Hopkins (9) and Murphy	40 W. M.	Carcinoma	Pos. (postop.)	Neg. (postop.)	Tissue, resected specimen; Pleural fluid (postop.)	Left lung	Generalized	Undecylenic Acid	Well, 8 months
10.	1951	Buechner (3) et. al.	56 C. M.	Carcinoma			Tissue, resected specimen	R.L.L.			Well, 9 months
11.	1951	Buechner (3) et. al.	49 W. M.	Carcinoma	Neg. (postop.)	Pos. (postop.)	Tissue, resected specimen; Sputum, (postop.)	R.U.L.	Spread in R.M.L. with cavitation	Potassium Iodide	Well, 1 year
12.	1951	Cummins (4) et. al.	39 W. M.	Carcinoma			Tissue, resected specimen; Skin lesion, (postop.)	R.U.L.	Skin lesions	Potassium Iodide and Stilbamidine	Well, 2 years
13.	1951	Good (8) et. al.	39 W. M.				Tissue, resected specimen				
14.	1951	White and Owen	60 W. M.	Carcinoma			Tissue, resected specimen	Left lung	Generalized		Died, 6 days
15.	1951	White and Owen	50 W. F.	Chronic Suppuration			Tissue, resected specimen	R.L.L.			Died, 18 hours
16.	1952	White and Owen	60 C. F.	Carcinoma			Tissue, resected specimen	Left lung			Well, 14 months
17.	1953	White and Owen	34 C. M.	Chronic Suppuration			Tissue, resected specimen	R.M.L.	Suspected spread right lung, (unproved)	Stilbamidine	Well, 10 months

ing, both inspiratory and expiratory, and coarse bronchial rhonchi in the upper half of the left lung.

Laboratory Data. Initial hemogram revealed the red cell count to be 4,650,000 per cu. mm. with a hemoglobin of 87 per cent; the white cell count was 9,900 per cu. mm. with 80 per cent granulocytes, 18 per cent lymphocytes and 2 per cent monocytes. Urinalysis was normal except for 1–3 red cells and 8–12 white cells per field. Serologic tests (Kline and Mazzini) were negative. Sputum examination revealed no tubercle bacilli. Fungus studies were not requested. An electrocardiogram showed no abnormal changes.

The chest roentgenograms showed a slight prominence of the left ventricle without gross enlargement of the heart. The apical portion of the left lower lobe was completely consolidated and there were multiple small cavities at the inferior limit of the consolidation. The infiltration extended across the fissure into the upper lobe posteriorly. There was no fluid or pleural thickening. The impression of the roentgenologist was "reinfection tuberculosis or bronchogenic carcinoma" (fig. 1A & B).

Course in the Hospital. The patient was started immediately on penicillin, 300,000 units, and dihydrostreptomycin, 0.5 Gm., twice daily, with large doses of vitamins and dietary supplements. Within three days his temperature was normal and never rose above 99 F. until the operation. On March 24, a diagnostic bronchoscopy was done. The trachea and right bronchial tree were negative. The left upper lobe bronchus showed a hemorrhagic area suggesting a tumor, but tissue for biopsy could not be obtained. A saline irrigation specimen of secretions from the left upper lobe was studied by the Papanicolaou technic, and no tumor cells were found.

The patient improved clinically but there was no change in the roentgenogram. Bronchogenic carcinoma still seemed to be the diagnosis of choice and exploratory thoracotomy was planned.

The Operation. On March 28, 1951, one of us (M. L. W.) explored the left chest through a posterolateral fifth rib approach. A large rubbery-hard, diffuse mass occupied the apex of the lower lobe, extending across the fissure into the upper lobe. There was no single lesion characteristic of carcinoma. Edematous vascular adhesions bound the lung to the posterior chest wall, and the mediastinal pleura was much swollen. The lesion was not thought to be a carcinoma, but the apparent infection seemed to demand pneumonectomy. The lung was mobilized with much blood loss from the parietal attachments of the adhesions, and was then easily resected, using the individual hilar ligation technic. He received 1,500 cc. of blood during the operation and was returned to his room in excellent condition.

Postoperative Course. The first five days were uneventful, the temperature declining rapidly from the peak of 102 F. on the first day. However, a portable chest film on the third day disclosed a small area of infiltration in the right cardio-phrenic angle (fig. 1C). On the sixth day he developed a very wet cough, and he raised thick mucopurulent sputum with difficulty. Thoracentesis, left, with removal of 350 cc. of clear yellow fluid brought some relief of symptoms. However, the following day (seventh postoperative day), circulatory collapse occurred rather suddenly and despite intensive salvage efforts, the patient died very quickly. Permission for postmortem examination was obtained.

Surgical Pathology. The cut surface of the left lung appeared bluish. There was a large indurated mass involving both the apex of the lower lobe and the lower portion of the upper lobe posteriorly. Small abscesses contained thick pus and many of the bronchi were filled with purulent exudate. The membrane of the bronchi showed no abnormalities. There was no gross evidence of carcinoma.

Microscopically, sections from the lung showed nodules of granulation tissue, with epithelioid cells and giant cells of the Langhans' type. In some areas there were fibrosis and micro-abscesses. Many of the giant cells contained fungi of the yeast type, typical of Blastomyces dermatitidis. The same fungi were found in the micro-abscesses and in the granulomatous tissue.

Postmortem Examination. The essential findings were limited to the thoracic cavity and

the heart, the abdomen being negative, and cranial examination being prohibited. The entire left pleural sac was filled with creamy, yellow-pink fluid. The right lung showed numerous consolidations throughout, which on cut surface were red, granular and irregular. Minute white spots were scattered throughout, especially beneath the pleura. Viscid, rusty colored material was present in the bronchial tree.

The pericardium was thickened, the visceral and parietal layers being spotted with reddish granular projections. About 100 cc. of creamy, pinkish pericardial fluid was present. The right heart was slightly enlarged and the myocardium flabby. The chambers and valves were normal. The coronaries showed sclerotic masses, but patent lumina.

On microscopic examination, sections of the mediastinal nodes showed granulomata and acute inflammatory changes with fungus infestation. The pleural and pericardial fluid revealed fungi in the dense purulent exudate. The pericardium showed actual granulation tissue. The right lung presented acute inflammatory changes with purulent exudate. The nodular consolidations were granulation tissue with epithelioid cells and a few giant cells. Blastomycotic fungi could be identified.

Comment on Case 1. This case presents especial irony. Although we had exhausted the *usual* means of establishing a positive preoperative diagnosis, the patient went to the operating table without a positive diagnosis. After the tissue diagnosis from the resected specimen was obvious, the Papanicolaou smear was reviewed and blastomycetes were found. Concentration on the possibility of carcinoma prevented the appraisal of the slide for other possible diagnoses.

The acute febrile onset and the persistence of such fever in a man appearing acutely ill on admission, despite previous thorough antibiotic treatment, should have aroused suspicion. Although a skin test and complement fixation studies were not done, it seems obvious that this man was in a quite unfavorable phase of his disease at the time of surgery. The first report of stilbamidine was probably in press, but even this, in retrospect, makes the failure to establish a diagnosis hard to accept. This case represents the typical acute dissemination following surgery in an unfavorable phase of the disease. This type of patient should do well in the future with *accurate diagnosis* and stilbamidine treatment, resecting, if necessary, the residual foci of disease.

One other feature supports comment. One day before death, the fluid in the left pleural space was clear and straw-colored. At postmortem examination, this fluid was definitely purulent. This seems to illustrate the astounding pyogenic tendencies of blastomycosis in an ideal culture medium.

Case 2

History. P. U. a white, 50 year old housewife from this city, was admitted to St. Mary's Hospital on June 1, 1951, for treatment of severe pulmonary complaints.

In 1944 she suffered a heart attack, diagnosed elsewhere as an "occlusion." Apparently this diagnosis was confirmed by electrocardiogram. However, for these succeeding seven years she had no cardiac or pulmonary symptoms whatsoever until the onset of her present illness four weeks ago. At this time she insiduously developed a severe cough productive of large quantities of very foul purulent sputum, occasionally streaked with blood. She had suffered two gross hemorrhages. There was no wheezing. A low grade fever with frequent drenching sweats had been present since onset of symptoms, and there had been a loss of 20 pounds in weight. She vomited infrequently.

Physical Examination. Examination revealed a severely ill woman, appearing somewhat older than her stated age. There was generalized perspiration, a cold, clammy skin, and an

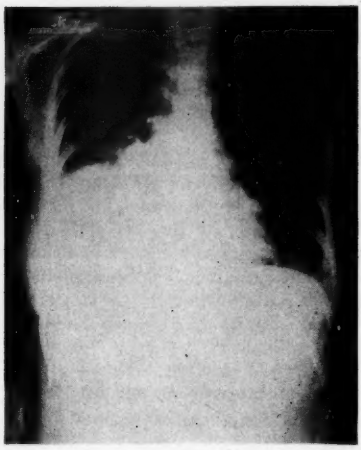

FIG. 2, Case 2. Showing dense consolidation with cavity formation in right lower lobe

almost constant *wet* cough. There was obvious dyspnea even at rest, but no cyanosis. The fingers were not clubbed. She appeared very anemic. There were coarse bronchial rales and fine crepitant rales throughout the right lower lung, anteriorly and posteriorly. The heart sounds were normal, but the blood pressure was 190/122.

Laboratory Data. Initial hemogram revealed the red cell count to be 3,450,000 per cu. mm. with a hemoglobin of 53 per cent; the white cell count was 11,600 per cu. mm. with 77 per cent granulocytes, 18 per cent lymphocytes, and 1 per cent monocytes, and 4 per cent eosinophiles. Urinalysis was negative except for 3–4 red blood cells per high power field. Serologic tests, (Kline and Mazzini), were negative. Three consecutive sputum examinations were negative for tubercle bacilli. Fungus studies were not requested. The corrected sedimentation rate was 46 mm.

The chest roentgenograms (anteroposterior and oblique views) revealed a slight gross enlargement of the heart in all diameters with slight right lateral retraction (fig. 2). The right lower and right middle lung lobes were consolidated, slightly reduced in size, and contained multiple small cavities. The left lung was clear. These findings seemed to represent severe cavernous suppurative pneumonitis, perhaps due to neoplasic obstruction.

An electrocardiogram revealed some evidence of coronary insufficiency.

Course in the Hospital. The patient's temperature on admission was 100 F., reached a high of 101 F. on the fourth hospital day, and then descended to a constant normal. Initial treatment consisted of penicillin, 100,000 units, every three hours for the first day, then 300,000 units twice daily; streptomycin, 0.5 Gm. twice daily; and terramycin, 250 mg. every four hours. On the day after admission bronchoscopic examination showed no evidence of a tumor, but there was a severe inflammatory reaction throughout the right bronchial tree with edema and redness of the membrane. From the middle and lower lobe orifices there emerged copious quantities of foul green pus. Three 500 cc. blood transfusions were given, but the red count rose only to 4,000,000 per cu. mm. and the hemoglobin to 72 per cent by June 12. The count dropped again to 3,440,000 per cu. mm. and 57 per cent on June 20. After five days of antibiotic treatment, she was vastly improved clinically. She had gained strength enough to become ambulatory, her cough was much less productive, and the sputum was thin and less purulent. However, there was no change in the appearance of the roentgenogram. Daily blood pressure recordings did not exceed 110/80, thereby throwing some doubt on the accuracy of the original reading by the house officer. Clinical improvement continued, but serial films showed no change in the lung. By the twenty-first hospital

day we thought that her improvement on the constantly administered antibiotics had reached its maximum, and that the irreversible suppurative changes in the right lower lung should be removed.

The Operation. On June 23, 1951, one of us (M. L. W.) explored the right chest through a posterolateral sixth rib approach. Upon opening the pleural space, we were amazed to find no adhesions whatsoever, but about 75 cc. of straw-colored pleural fluid. The lower lobe was very indurated, and completely diseased throughout, but the upper and middle lobes were normal. The visceral pleura over the lower lobe was thick and edematous, and when incised, edema fluid escaped. The lower lobe could not be separated at all from the adjacent lobes by natural fissure lines. In spite of this, lobectomy was thought to be the procedure of choice, and an individual hilar ligation was done, sharply dissecting the lower lobe from the adjacent lung. It is interesting to note that soon after the chest was opened, the anesthetist noted expiratory wheezing, and he maintained good color with some difficulty throughout the operation. However, the wheezing became much better after the chest was closed and she was returned to her room in good condition, with only a mild expiratory wheeze. Three thousand cc. of blood were given during the operation, 1,000 cc. in excess of her estimated loss because of the persistent preoperative anemia.

Postoperative Course. About six hours after surgery, the wheezing increased in severity and she was given adrenalin, ephedrine, aminophyllin, and ACTH without relief. By midnight her condition was serious. There was dyspnea due to expiratory wheezing. She was fully digitalized and the above drugs were administered repeatedly without effect. She finally died in acute asthma 18 hours following operation. Permission for postmortem examination was denied.

Pathology. The specimen showed a thick, edematous pleural covering. The cut surface showed a peculiar, gland-like structure with yellow meshes and white network. Yellow plugs were easily pressed from the lung. The bronchi were generally dilated and filled with red exudate. Microscopic examination showed foci of granulomatous tissue made up of epithelioid cells, lymphocytes and plasma cells. There were leukocytes, especially eosinophiles, and foreign body type giant cells. Some of the giant cells included round and clear bodies with a double refractile membrane, some of which were budding. These were typical of blastomycosis dermatitidis. Some of the alveoli in the outer areas of the granulomata were filled with lipoid-loaded macrophages.

Comment on Case 2. The febrile course, the severe productive cough with foul purulent sputum, the persistent anemia despite blood replacement therapy, the extremely ill appearance of the patient and the roentgenograms, all pointed toward a severe bacterial destruction of pulmonary tissue. The failure of more clinical improvement, and the lack of improvement in the pneumonic process in the roentgenogram should have aroused suspicion that this was not an ordinary case of pulmonary suppuration. Fungus infection frankly was never considered as a possibility. She was obviously in a most unfavorable phase of her fungus infection, even after some improvement prompted surgery. With no previous history of allergic diseases, she died with acute asthma. Although no precedent can be found for this assumption, it is believed she developed an overwhelming allergy to the release of blastomycin at the time of operation. The *auto-tuberculinization* death of certain tuberculous patients following resectional surgery in the prestreptomycin era is vividly recalled.

Case 3

History. M. H., a 60 year old negro housewife from this city, was admitted to St. Mary's Hospital on Nov. 10, 1952, under the care of an internist. She had been known to have

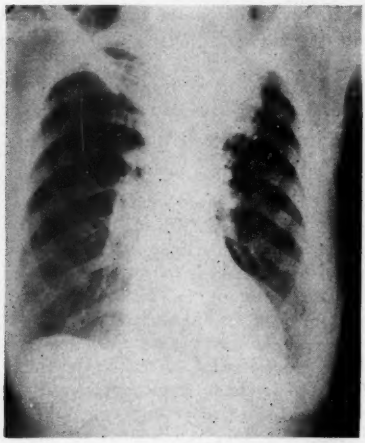

FIG. 3, Case 3. Showing dense consolidation, left upper lobe

arteriosclerotic heart disease with auricular fibrillation for several years, and had suffered at times from dyspnea and ankle edema. She had been digitalized and kept on daily maintenance doses for three or four years. Hypertensive blood pressures had been recorded on numerous occasions. About three months before admission she developed a dry, nonproductive cough which gradually increased in severity until five weeks prior to admission, when she developed very severe paroxysms of coughing with much weakness and anorexia. A few days before hospitalization she began a febrile course with fever up to 105 F. The cough then became productive of moderate quantities of mucopurulent sputum without blood. A course of penicillin was given before admission without improvement of fever or symptoms. Since onset, she lost 15 pounds in weight.

Physical Examination. Examination revealed a very tall and slender Negro woman, looking several years older than her stated age. Her temperature was 104.4 F. with a pulse rate of 90. The heart was slightly enlarged with a soft systolic murmur, and the rate was irregular, suggesting auricular fibrillation. The blood pressure was 140/86. There was dullness over the left upper chest with decreased breath sounds, but no rales.

Laboratory Data. Initial hemogram showed the red cell count to be 3,690,000 per cu. mm. with a hemoglobin of 69 per cent; the white cell count was 7,500 per cu mm. with 84 per cent granulocytes, 15 per cent lymphocytes and 1 per cent monocytes. Urinalysis was completely negative. Serologic tests (Kline and Mazzini) were negative. Sputum examination for tubercle bacilli was negative. The blood non-protein nitrogen was 28.5 mg. Fungus studies were not requested. The chest roentgenograms showed a slight increase in the diameter of the heart. There was a complete consolidation of the apex of the left upper lobe with small cavities or abnormally dilated bronchi (fig. 3). There was also slight superior retraction of the lung root, but no pleural fluid. The right lung was entirely clear. These findings were attributed to pulmonary tuberculosis, but a bronchogenic carcinoma with necrosis was strongly considered.

An electrocardiogram disclosed auricular fibrillation with some evidence of myocardial damage.

Course in the Hospital. The febrile course continued with daily elevations of 103 F. to 105 F. for nine days and then began to drop to a daily peak of about 100 F. Her pulse ranged from 84 to 120. Penicillin, 600,000 units, and streptomycin, 1 Gm. were started daily on the third hospital day. Penicillin was discontinued two days later, and gantrisin was begun. Her daily dose of digitalis was continued. Clinical improvement was marked after nine days

of treatment, and bronchoscopy was done on the tenth day. No significant abnormalities were found. Antibiotics were continued with gradual clinical improvement, but without change in the roentgenogram. With obvious trepidation, because of the cardiac condition, we finally advised exploratory operation because of the fear of malignancy.

The Operation. On Dec. 5, 1952, the twenty-fifth hospital day, the left chest was explored through a posterolateral fifth rib approach. The entire apex of the upper lobe was a great mass of infiltration with diffuse adhesions binding the lung to the thoracic dome. Palpation revealed no typical areas of carcinoma and the lymph nodes were soft and small. A wedge of tissue was removed for frozen section examination and the report was, "an unusual infection, very probably blastomycosis." A pneumonectomy was done easily by the usual technic.

Postoperative Course. The patient's course was quite mild, the highest temperature being 100 F. She was not unusually dyspneic. Serial roentgenograms showed no evidence of spread of the disease, and she left the hospital on the ninth postoperative day.

Pathology. The cut section of the left upper lobe showed consolidations of yellow, granular tissue from which pus could be expressed. The lower lobe showed only a few atelectatic and hemorrhagic areas. The hilar nodes were grossly necrotic with purulent exudate.

Microscopic sections of the indurated areas revealed granulomata with Langhans' type giant cells and numerous polyhedral cells which were vacuolated. There were many microabscesses in the granulomata, but no necrosis. The lung parenchyma showed diffuse inflammatory infiltrations. Numerous fungi of the yeast group, typical of blastomyces dermatitidis, were found free in the tissues and within the giant cells.

Subsequent Course. She was seen on numerous occasions as an ambulant office patient. The pleural space filled very slowly with fluid, and retraction of the mediastinum was severe within two months. However, there was no evidence of any recurrence of the disease. Seven months after operation, she was readmitted to the hospital by her internist because of dyspnea and pain in her left chest. Roentgenograms at this time again showed a clear right lung, but the mediastinal retraction was very marked. The severe displacement of the heart was indicted as a cause of the dyspnea and a one stage thoracoplasty advised, but the patient refused. The patient was last seen in February 1954, 15 months following operation. Roentgenographic examination again revealed no dissemination of the disease. She was very dyspneic and had pedal edema, in spite of mercurial diuretics and digitalis.

Comment on Case 3. In view of the violent febrile course exhibited just three weeks prior to operation, it seems unusual that this patient never presented evidence of any dissemination of the disease. The decision to do a pneumonectomy rather than a lobectomy is open to criticism. She had practically no interlobar fissure, which would have rendered lobectomy technically difficult. Furthermore, at the time of her operation, we still feared dissemination, and were more radical in the resection as in the early era of resection for tuberculosis. The disabling cardiac failure could very likely have been delayed by thoracoplasty which was refused.

Case 4

History. A. W. a 34 year old negro soft coal miner from southern West Virginia, was admitted to St. Mary's Hospital on March 28, 1953. His complaints centered chiefly around a pleuritic pain throughout the right side of his chest. He was apparently perfectly well, performing hard manual labor, until the onset of this pain six weeks prior to admission. After two weeks of this single symptom, he began to have fever, occasional chills, cough and purulent expectoration, occasionally tinged with blood. A diagnosis of pneumonia was made by his local doctor and he was treated with antibiotics, presumably penicillin. This treatment resulted only in a subsidence of his fever, the other symptoms persisting.

The persistence of these symptoms, and the failure of resolution of a large shadow in the right lung by roentgenogram, prompted the referral to this hospital.

Physical Examination. Examination revealed a very large, muscular Negro man of stated age. He appeared in robust health, except for an occasional "wet" cough. Positive physical findings were limited to the chest where dubious dullness was found anteriorly in the lower right chest and breath sounds were of a tubular nature.

Laboratory Data. Initial hemogram showed the red cell count to be 3,820,000 per cu. mm. with a hemoglobin of 76 per cent; the white cell count was 11,600 per cu. mm. with 62 per cent granulocytes, 33 per cent lymphocytes, 2 per cent monocytes and 3 per cent eosinophiles. Urinalysis was completely negative except for an occasional leukocyte. Serologic tests (Kline and Mazzini) were negative. Sputum examination was negative for tubercle bacilli. No fungus studies were requested.

The chest roentgenograms revealed a complete consolidation without volume shrinkage of the right middle lobe (fig. 4A & B). The remaining lobes of the right lung and the left lung were clear. There was a very slight dilatation of the arch of the aorta. Interpretation of these films by the roentgenologist was "consolidation of the right middle lobe consistent with and attributed to lobar pneumonia."

Course in the Hospital. The patient's temperature on admission was 98.8 F. It never exceeded 99.4 F. during the 14 days of conservative treatment. Initial treatment consisted of penicillin, 600,000 units and erythromycin 800 mg. daily. Large doses of vitamins, especially ascorbic acid, were given, with a palliative cough sryup. On March 30, a diagnostic bronchoscopy showed only a mild subacute bronchitis in the right bronchial tree with small quantities of mucopus emerging from the right middle lobe orifice. New roentgenograms made on the fourth and twelfth hospital days showed no change whatsoever, in spite of the fact that streptomycin and gantrisin had been added to the therapeutic armamentarium. We thought, then, that this patient had irreversible necro-suppurative changes in the middle lobe, and planned excisional surgery.

The Operation. On April 11, 1953, one of us (M. L. W.) explored the right chest through a posterolateral sixth rib approach. The middle lobe was of normal size, but extremely hard in consistency, and somewhat bluish in color. The upper and lower lobes were normal. Sharp dissection was necessary to divide extremely dense vascular adhesions binding the middle lobe to the anterior parietal pleura and to the pericardium, but both fissures separated with only minor difficulty. However, in the development of the transverse fissure, the middle lobe was torn in several places. No pus escaped, but the appearance was that of extremely indurated chronic infection with no suggestion of carcinoma. A small biopsy specimen was removed for frozen section diagnosis, and the immediate report was "probable fungus infection." This single lobe was resected with the usual individual hilar ligation technic. Blood loss was excessive from the parietal attachments of the adhesions, and it was finally necessary to control this bleeding with the electrocautery. Five pints of blood were given during the operation and the patient was returned to his room in excellent condition.

Postoperative Course. The immediate postoperative course was uneventful except for a pleural reaction more severe than in the usual resection. The highest temperature was 100.4 F. on his first postoperative day. The remaining lobes expanded well, and serial roentgenograms showed no spread of disease in either lung. He was discharged in excellent condition on April 21, the tenth day following operation.

Pathology. The surface of the specimen was covered with a firm, pale red membrane averaging 0.5 cm. in thickness. When incised, the lung parenchyma was dark, firm, and granular, with projecting yellow spots easily compressed. The bronchi were slightly dilated. Microscopic examination showed destruction of the lung by specific granulation tissue made up of epithelioid cells and giant cells of Langhans' type. There were small abscesses scattered throughout. Around these micro-abscesses were fungi, typical of Blastomyecs dermatitidis.

Subsequent Course. A roentgenogram mailed in to us on May 4, 1953, revealed only the

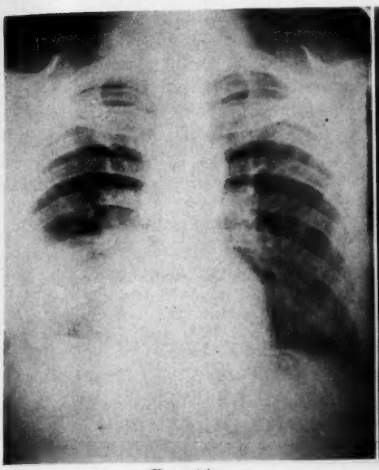

FIG. 4A

FIG. 4B

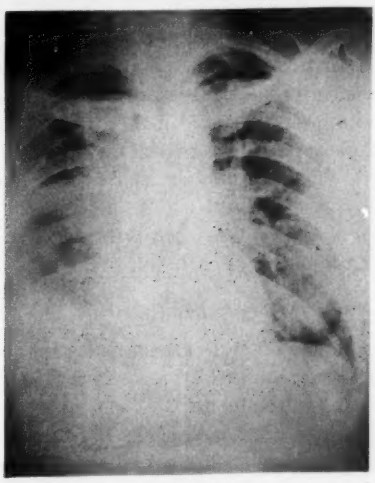

FIG. 4C

FIG. 4, Case 4. A. & B. Posteroanterior and right lateral films showing consolidation of right middle lobe. C. Shows suspected but unproved recurrence of disease in right lung.

usual postlobectomy pleural changes. The patient then moved to another city and on June 11, 1953, was seen by a thoracic surgeon there because of severe pain in the right chest. A report from him states that he found nothing unusual on physical examination of the chest, and a roentgenogram again showed no evidence of disease. An intercostal nerve block relieved his discomfort. Of great interest at this time was the occurrence of a small cutaneous lesion on the right thigh, unhealed for two weeks. This was excised and the pathologic diagnosis was "subacute and chronic inflammation of a follicular cyst with no evidence of fungus".

We saw the patient next on June 29. He still complained of some pain and was quite apprehensive, but roentgenogram and physical examination showed no recurrence and he was given permission to return to work. Again on August 31 he found to be in excellent condition both clinically and by roentgenogram in our office.

In September 1953 he was again admitted to a hospital in his home town because of what was thought to be a recurrence of the disease in the right lung (fig. 4C). Because of this suspicion, he was given stilbamidine, 150 mg. daily for 15 days (2.25 Gm.). The shadow cleared within one month. A letter of Jan. 20, 1954, from his attending physician states that he was "very well and has no more complaints with his chest."

He was examined next in our office on Feb. 22, 1954. His general health was excellent and he had no complaints except residual soreness around the right lateral chest. Roentgenograms showed no evidence of any disease. Within the past three weeks he had developed numbness of the upper lip on each side of the mid-line.

Comment on Case 4. It should be noted that this large, apparently healthy, Negro man had no significant symptoms except pleuritic pain on admission to this hospital. One roentgenographic feature contested the diagnosis of a "middle lobe syndrome"; the lobe had suffered no volume shrinkage. Although the diagnosis was not suspected before surgery, it seemed obvious that the right middle lobe had undergone permanent destructive changes without evidence of *activity* of the infection at the time of operation.

The assumed recurrence of the disease in the right lung five months following surgery was not proved. At this time, he was under the care of another surgeon. A study of these roentgenographic films substantiated the logic of his suspicion of a recurrence. The administration of stilbamidine seemed justified. However, the shadow cleared completely within a month on only 2.25 Gm. of stilbamidine. The rapid clearing with this relatively small dosage casts some doubt on the diagnosis of recurrence.

It is also interesting to note that five months following stilbamidine treatment, this man began to have numbness of each half of his upper lip.

CONCLUSIONS

It is obvious that no feeling of pride accompanies the presentation of these 4 cases in view of the disastrous mortality rate. It is hoped that these errors in diagnosis may be prevented in the future.

It is the authors' conviction that pulmonary blastomycosis should be treated medically with the excellent new antifungal chemotherapeutic drugs, reserving resectional surgery for the residual foci of irreversible pulmonary damage. Free comparison with the history of surgery in tuberculosis renders this concept logical. To follow this ideal, accurate diagnosis demands alertness as to the possibility of fungus lesions, and the diligent search of bronchial secretions for the presence of the organism.

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SURGICAL REPAIR OF A LARGE OMPHALOCELE: CASE REPORT*

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Much work on the problem of repairing large omphaloceles has been done, but ultimate success is yet to be attained. The condition is so rare—about 1 in every 5,000 births[5]—that all cases with any noteworthy features whatever should be reported.

By definition "an omphalocele is a herniation of abdominal viscera into the base of the umbilical cord: the pouch is a thin, translucent structure consisting only of peritoneum and amniotic membrane."[3] There is a complete absence of all layers of the abdominal wall—except peritoneum—for the full diameter of the opening.

Several facts about omphaloceles are rather well established. They are as follows:

1. Where the sac is large, the defect in the abdominal wall is usually large also.

2. The mortality rate is directly proportional to the diameter of the sac. Gross[2] found when the diameter was less than 7 cm. there was a survival rate of 75 per cent; if from 7 to 9 cm., a survival rate of 30 per cent; if greater than 9 cm. a survival rate of only 15 per cent.

3. When the sac is large, usually the liver makes up the major part of its contents.

4. The more liver in the sac, the higher the mortality rate.

5. The defect in the abdominal wall may be relatively small even with a large sac. This is unusual but means reduction may necessitate opening the sac and enlarging the abdominal defect.

Primary repair of the opening is feasible only when the defect is small. Here excision of the sac and an anatomic repair are possible. However, in dealing with large defects a two stage procedure has been evolved[3] which is a much safer method. At the first operation the adjacent skin is widely undermined, and the entire unopened sac is covered with it. The umbilical cord is cut off flush and its stump is covered by the skin flaps. The repair of the defect itself is the second step, and is done at a later date when the abdominal cavity easily accomodates all viscera.

Cutis grafts have been used in 1 case.[4] Benson[1] has urged that the sac be opened to search for any associated anomalies, and this point is worthy of consideration.

Two other points have been stressed in the literature; first, that the amniotic membrane has very little tensile strength, and second, that it is very permeable to bacteria.

* Presented during the Salt Lake City assembly of The Southwestern Surgical Congress, September 21–23, 1953, Salt Lake City, Utah.

The case reported here was the fourth in my experience. The other 3 were female infants, this being the only male. One of the 3 is still living and well—11 years of age—1 died of a heart lesion six months after a successful omphalocele repair, and 1 died 48 hours postoperative. This last one had the sac ruptured during or prior to delivery. There was also an incomplete development of small bowel and colon.

CASE REPORT

Baby P, white male, delivered at full term Jan. 5, 1952, was referred to me by Dr. Allan Bloxsom. Operation was done about four hours after delivery. The sac was unruptured; was at least 9 cm. in diameter, with a correspondingly large abdominal wall defect. Even under general anaesthesia very little reduction was possible. The skin was undermined widely enough to suture its edges over the sac without tension. The edges were sutured closely around the umbilical cord stump. The suturing was in a transverse direction. Two days later the tension was less in the mass, and it appeared reduced at least ¼ in size. Four days postoperative the mass was again larger, and gas was noted in the intestines. Five days postoperative the cord stump had shrunk materially, and the edge of the upper skinflap appeared under increased tension at this point. Seven days postoperative the baby was better, the mass smaller during sleep, and the skin edges seemed in good condition. Eight days postoperative the condition was still good; the mass seemed about ½ reduced in size, and the skin appeared viable.

On January 20, or 15 days postoperative, the umbilical cord was cut off flush and the skin edges were sutured over the stump. This was done without anaesthesia and did not disturb the baby. The next day there was a great increase of internal pressure causing separation of the suture line. The sutures placed the day before all cut out, and the skin flaps had become so thin that they were without holding value. Rupture and eviseration were regarded as imminent unless additional reinforcement was made. The sac was opened under general anaesthesia. The incision was made in a curved fashion, its center being just below the site of the umbilical cord, and its ends curving upward in the free peritoneal space on each side (fig. 1). The upper flap of amniotic membrane was turned upward enough so that the round ligament of the liver could be cut between ligatures (figs. 2 and 3). Then the entire upper flap was easily mobilized from the liver and carried downward (fig. 4). The lower flap was pulled upward and overlapped on the upper one as in the repair of an umbilical hernia by the Mayo method. A single row of interrupted sutures was placed, using no. 0 chromic catgut on atraumatic needles (fig. 5). Knowing nothing of the actual tensile strength of this membrane, I tried to further reinforce it by suturing a piece of no. 165 stainless steel wire mesh on top of it, using a few interrupted black silk sutures. Four days later it was obvious that the wire mesh was acting merely as a foreign body and had become completely detached. It was easily lifted out, and there was considerable drainage.

Further plastic procedure was not considered feasible. Evisceration occurred

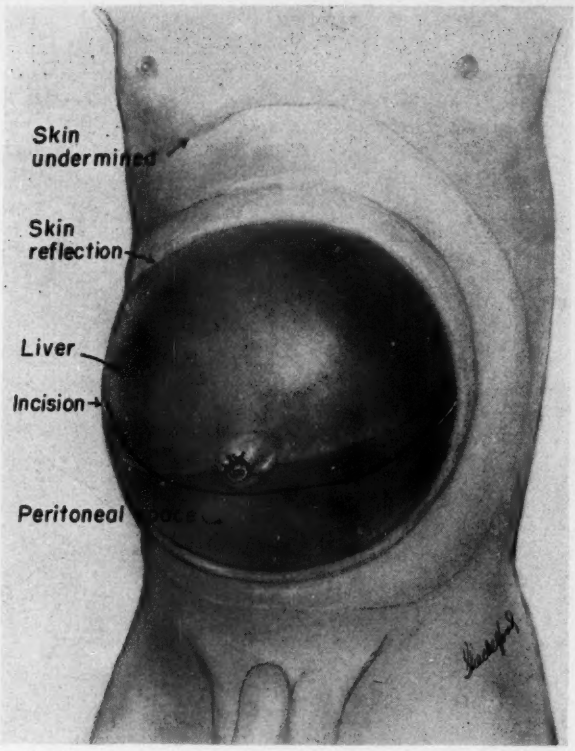

FIG. 1. Curved incision in free peritoneal space from side to side just below liver edge.

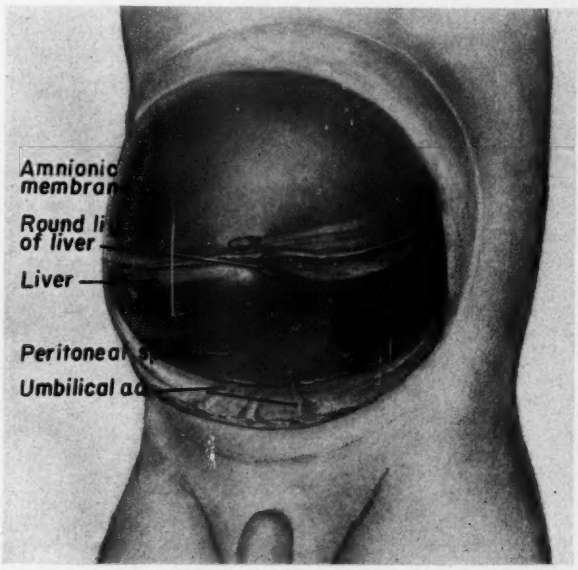

FIG. 2. Opening of sac in this manner easily exposes round ligament, and gives wide exposure and easy access to other abdominal viscera.

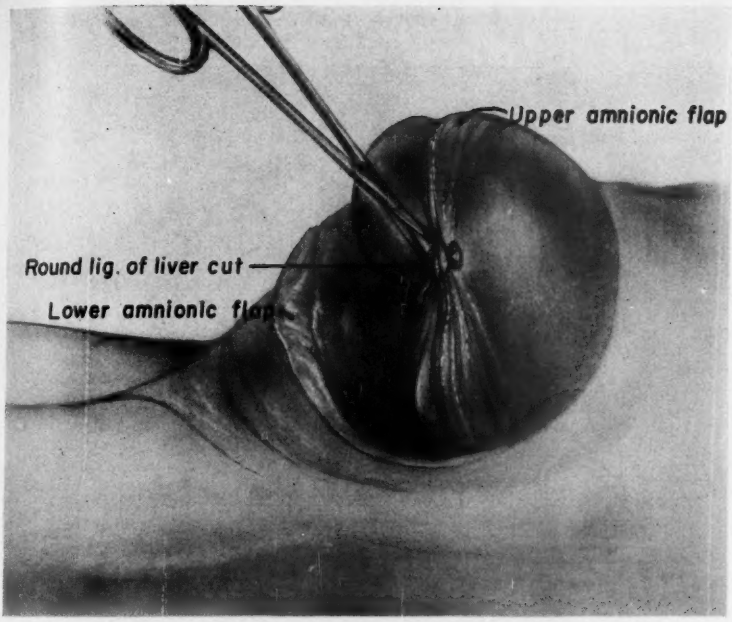

FIG. 3. Cutting round ligament gives maximum mobilization of upper flap, and increases to some extent the mobility of the liver. Hemostasis when cutting round ligament is important.

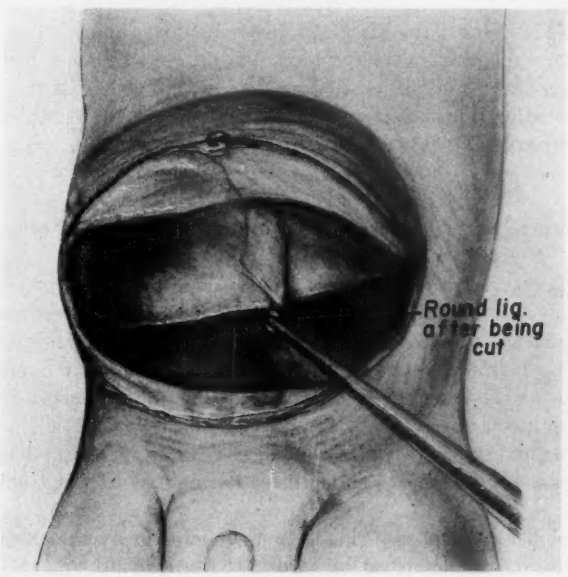

FIG. 4. Mobilization of upper flap

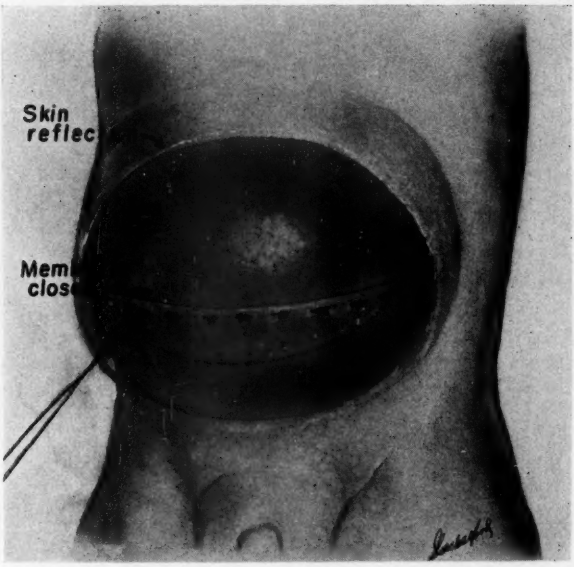

FIG. 5. Overlapping of amniotic flaps, using interrupted sutures of no. 0 chromic catgut, with atraumatic needle. In case reported this single row held for nine full days as the sole protection against rupture and evisceration.

on Jan. 30, 1952, nine days after the flap repair was made. The overlapped amniotic membrane, without benefit of any skin flaps, alone had prevented rupture during these nine days. It should be noted that this flap repair was done 16 days after the original primary operation. When death occurred, 48 hours after evisceration, there was no evidence of peritonitis.

DISCUSSION

Based on a review of the 4 cases here recorded, the following observations are offered.

1. Since the round ligament of the liver is directly continuous with the umbilical cord, it is obvious that when the umbilical cord arises from the distal half of the sac most of the liver, if not all, must necessarily be in the sac (figs. 6 and 7). Also, the more distal the origin of the cord, the more liver is apt to be present in the sac. Hence a first glance will show in large measure how serious a problem the surgeon has on hand.

2. An entire liver seldom can be reduced primarily. The abdominal cavity before birth has shrunk to accomodate for its absence; it must enlarge for its replacement.

3. The umbilical cord stump should be covered over by the skin flaps at the primary operation, as described by Gross.[3] Failure to do this will result in a

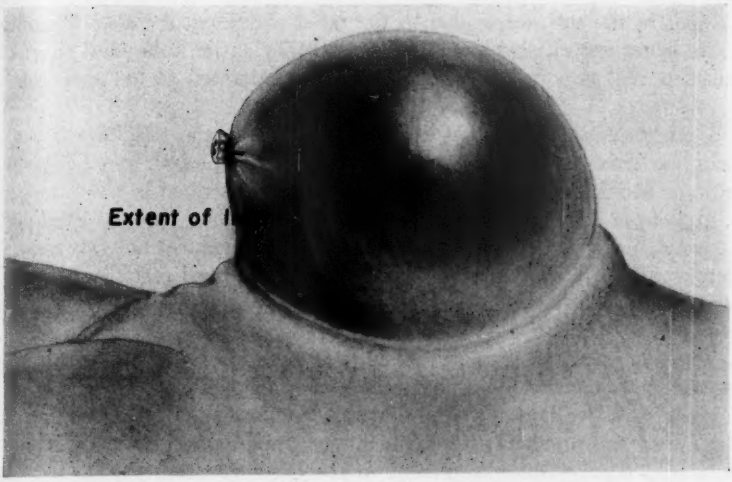

FIG. 6. A large omphalocele. Note site of origin of umbilical cord

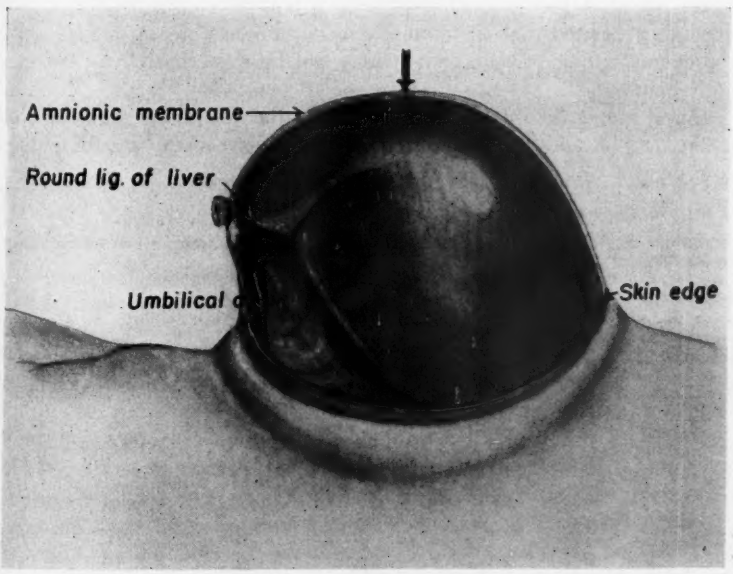

Fig. 7. Cutaway view of figure 1. Note attachment of liver to umbilical cord site by round ligament. Obviously the more distal the location of the origin of the umbilical cord on the sac, the more liver mass will be present in the sac. Also, the sac will contain relatively small amounts of bowel and other viscera.

weak spot in the suture line due to the rapid shrinking of the cord stump, if the skin edges are sutured around the stump. I mention this point specifically because its real importance had not been demonstrated to me until this last case.

4. I am now convinced that the amniotic membrane has, or can rapidly develop, far greater tensile strength than hitherto suspected, and I believe the membrane should be utilized. The method herein described is very simple and easy to perform. The curved incision in the free peritoneal space allowed perfect exposure of all abdominal organs. Cutting the round ligament not only mobilized the upper flap to a maximum, but also allowed increased mobility in reducing the liver mass. I believe that further experience with this maneuver will prove its true value.

5. The fact that the amniotic membrane alone prevented rupture for nine days, and that considerable drainage developed following the placement of the wire mesh for a few days, suggests that this membrane is *NOT* as permeable to bacteria as I had previously thought. Surely ample opportunity for peritonitis by bacterial permeation was present in the case reviewed, yet no peritonitis developed.

SUMMARY

A case report of the surgical treatment of a large omphalocele is recorded. Evidence is presented that the amniotic membrane has greater tensile strength than previously thought, and that it may not be as permeable to bacteria as formerly believed.

A surgical maneuver by which inspection of the abdominal organs for other anomalies may be made, plus utilization of the amniotic membrane for additional reinforcement is described in detail.

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CYSTIC HYGROMA OF THE AXILLA

A CASE REPORT

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Cystic hygroma represents an endothelial-lined cyst derived from the lymphatic system and is congenital in origin. It usually is encountered in infancy and childhood, but may not become apparent until later in life. Reviews have been made of the reported cases by Vaughn[10] and Dowd[1] and in 1938 a pathologic study of 12 cases personally observed was made by Goetsch.[3] Gross[4] has made a complete study of 112 examples of cystic hygroma occurring in infants and children.

Cystic hygromas have been described in various regions of the body, but approximately 80 per cent of all hygromas occur in the cervical region. Less frequent sites are the axilla, chest wall, groin and retroperitoneal area. Grossly the lesions are either unilocular or multilocular; the walls are extremely thin, and the fluid contained therein is usually colorless or straw-colored. The mass is of variable size; is soft, compressible, and may or may not transilluminate light, depending upon the presence or absence of hemorrhage within the cyst.

Several theories have been proposed to explain the embryogenesis of the lymphatic system. Huntington[6] believes that endothelium-lined lymph sacs of the neck and other areas of the body develop directly from mesenchymal tissues and by ramification and coalescence obtain their connection with the venous channels.

According to Sabin[9] small endothelium-lined outpocketings arise from the jugular vein which become detached and form the primitive lymphatic sacs. From these sacs the growing lymphatic vessels unite and become a system which eventually acquires communication with the various veins.

Goetsch has demonstrated to his satisfaction, by histologic means, that hygromatous cysts arise primarily by the formation of fibrillar membraneous sprouts derived from the lining walls of the cystic spaces. By penetration into surrounding tissues and subsequent canalization of the sprouts, cysts are formed which in turn propagate themselves in a manner somewhat analogous to the development of the early lymphatic system.

Symptoms seen in most cystic hygromas are slight, and pain or local discomfort is not frequently encountered unless secondary infection has supervened. Interference of a mechanical nature may occur in certain locations. Pressure symptoms, secondary to pressure on important structures, such as the trachea, pharynx, floor of the mouth, mediastinum, or nerve trunks, has been noted. The chief complaint usually is related to the disfigurement which occurs from the presence of the lump.

A positive clinical diagnosis often is not made because of the rarity with which

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the lesion occurs, particularly when found in the extra cervical regions. As a rule the tumor is soft, fluctuant, and multilocular, when occurring in the cervical or axillary regions and shows progression in size when followed for several months. The tumor usually is not tender. It is not attached to the overlying skin. It transilluminates with a bright light, unless secondary hemorrhage has occurred in the tumor.

A variety of treatments have been used which have included aspiration, which has no intrinsic harm if aspiration is not followed by infection. The diminution in size of the swelling by aspiration usually is only temporary and reaccumulation of fluid in the tumor is prompt. MacGuire[7] and Harrower[5] have used sclerosing agents. It has been pointed out, that theoretically it would seem that, because of the thinness of the lining of a hygroma, injection therapy would be ideal treatment, but because the hygroma is apt to dissect toward a large vessel a necrotizing agent introduced into the sac might tend to thrombose an adjacent vessel. Radium therapy was used as treatment by New,[8] and later by Figi[2] in a report of 12 patients in whom radium had been used as the therapeutic agent. Surgical excision is probably the most satisfactory method of treatment for the great majority of cystic hygromas.

CASE REPORT

Mrs. J. H., a white woman, aged 53, was first seen by one of us (G. F. M.) on Oct. 26, 1953. She gave a history of a tumor in the left axilla which had been aspirated twice by the referring physician. On each occasion straw-colored fluid was removed and in a very short time the tumor would reappear. During the past few weeks the patient stated there had been a rapid growth in the tumor in the left axilla and accordingly she was referred for further treatment.

Physical examination revealed a mass in the left axilla which was the size of a small orange. It was cystic, freely movable and not attached to the skin. It transilluminated light slightly, but because of the thickness of the overlying skin and subcutaneous tissue transillumination was difficult. It was not tender. Her family history was essentially negative, and at the time of a previous hospital admission elsewhere, March 29, 1949, the complete physical examination was reported to be negative.

A diagnosis of a benign cystic tumor in the left axilla was made and on Oct. 28, 1953 the lesion was excised. The mass, at the time of operation, was approximately 10 cm. in length and measured 6 cm. in diameter. It was lobulated and contained clear fluid. There was a small duct 0.5 cm. long which passed up to connect with the lymphatics along the subclavian vein approximately 5 mm. in diameter and appeared to be the feeding channel for the cystic tumor. The mass was removed intact and the patient's postoperative course was uneventful.

PATHOLOGIC REPORT

Gross. The specimen was a rather large cystic tumor that showed a thin, smooth outer wall, except at one end, where strand-like connective tissue was seen. The dimensions were 10 by 6 by 6 cm. (fig. 1). There was slight lobulation seen on the outside surface. The total weight of the tumor was 150 Gm. On opening the tumor it contained 100 cc. of straw-colored fluid which will be discussed later.

The inner surface of the cyst showed a smooth, glistening wall that was paper thin in most of the areas (fig. 2). However, there was a hint of trabeculation, which indicated that originally there might have been septa separating the cyst into several compartments. In that portion of the wall which was thickest, fatty tissue was present and in one area a

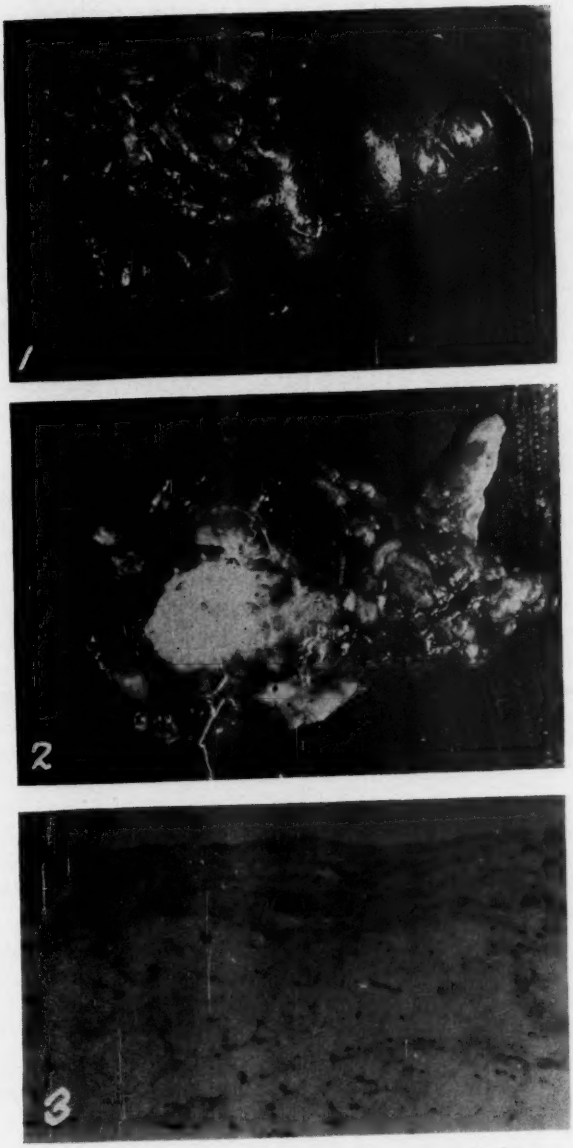

FIG. 1. Tumor intact. Reduced approximately ⅓

FIG. 2. Tumor after being opened. The glistening inner lining can be seen with faint septa that were described grossly.

FIG. 3. Wall structure seen microscopically. The cyst cavity is seen above, lined by endothelium, and then supported by loose connective tissue and fat. (× 100, H and E stain).

small lymph node was identified. One thread-like strand was found near one end of the tumor. It represented a partially obliterated lymph channel.

Microscopic Fingings. The thin portions of the wall showed an inner lining of orderly endothelium, a single layer in thickness. This lining was supported by loose connective tissue and a small amount of fatty tissue (fig. 3). Incorporated in this wall were a few blood-filled vascular channels and a very occasional nerve bundle.

The thicker portions of the wall showed the same inner endothelial lining, but more connective tissue proliferation in the outer portions. This connective tissue contained lymphatic channels, capillaries, small arterioles and small venules. Two different lymph nodes were identified which showed normal architecture. Inflammatory changes were slight, but in a few places lymphocytes were present in the connective tissue.

Fluid Analysis. The specific gravity of the fluid was 1.016. The total protein determination showed 3.7 Gm. per cent with the albumin level of 2.55 Gm. per cent and the globulin level of 1.2 Gm. per cent. This gave an A/G ratio of 2.1 to 1. The chloride content was 690 mg. per cent, (118.9 m Eq/l). The calcium level was 9.6 mg. per cent (4.8 Eq/l), sodium 302.2 mg. per cent, (131.3 m Eq/l), potassium 20.9 mg. (5.4 m Eq/l), and cholesterol low with a value of 77 mg. per cent. A smear of the material showed an occasional lymphocyte.

SUMMARY

Cystic hygromas occurring in the axilla are rare. A case is presented which occurred in an adult and was located in the axilla with a demonstrable connection with the lymphatics along the subclavian vein. When cystic hygromas are found they are thin-walled cystic tumors lined with endothelium and containing lymph. Embryologically their exact origin is not clear, but there seems to be little doubt that a pinching off of tissue from lymphatic sacs in the fetus occurs, which in time give rise to an endothelium-lined lesion which is called a hygroma. Symptoms usually result from a mechanical disturbance secondary to the tumor. The diagnosis often is not made when found in the extra-cervical region because of the rarity of the lesion. Numerous methods of therapy have been recommended but surgical removal is the most satisfactory method of treatment.

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SOLITARY CYSTS OF THE SPLEEN*

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Cysts of the spleen are uncommon and interesting lesions, their chief importance perhaps arising in the differential diagnosis of abdominal masses. A review of the subject is prompted by a recent patient in whom there was a large left upper quadrant abdominal mass which at operation proved to be a huge pseudocyst of the spleen. Added interest is given this patient because her mother was operated upon at an early age, at which time a large abdominal cyst was removed which may have been a solitary pseudocyst of the spleen.

In a review of the literature one is impressed by the fact that most authors comment upon the rarity of cysts of the spleen of all types, pointing out that they seem to occur most often in women, and that trauma at some previous date may be an important etiologic factor. Numerous classifications are given, but perhaps the most simple one is that of a division into *true* and *false* cysts.

Fischl[4] believes that the diagnostic features of a solitary splenic cyst are sufficiently obvious to justify diagnosis prior to operation. He points out that the stomach is displaced towards the right; the left diaphragm is elevated, and that on fluoroscopy the left costophrenic sinus will be found to be clear and the diaphragm fixed. In some instances the kidney is displaced inferiorly, and in others it is displaced to the right towards the midline. Some cysts of the spleen are calcified, but apparently these are even more rare than the large solitary pseudocysts. Snoke[10] emphasizes that, in those instances where there is calcification, the differential diagnosis between aneurysm of the splenic artery and calcified cysts of the spleen must be made. This can be done with the stethoscope; the aneurysm being distinguished by a systolic bruit. Pulsation may or may not be present over a splenic artery aneurysm. Sweet[12] mentions that on physical examination the left costal margin is usually pushed outward by the tumor which always extends beneath it. This does not, as a rule, occur in pancreatic cysts, and rarely occurs in ovarian cysts. He made the interesting observation in the 3 cases which he reported that the cyst always developed in the upper pole, leaving a small intact triangular lower pole. This is of some significance in that it occasionally casts a shadow which is of diagnostic significance in the roentgenogram.

Denneen,[3] in a report of 5 cases of what he termed *hemorrhagic cysts of the spleen*, pointed out that two-thirds of such cysts occur in females, and mentioned the long interval between a history of injury and the possible development of the cyst. Icenogle[5] also mentions, and tends to stress somewhat, the long time interval between the history of trauma and the appearance of the cyst. In 1 of his patients, a female, age 17, there was a history of trauma at age 3½, and later

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the development of a splenic cyst at age 17 years. He, along with many other authors, also mentioned that the contents of the cyst frequently contained shimmering, glistening particles thought to be cholesterol crystals. Martin,[7] in reporting a case of calcified cyst of the spleen, mentioned that this type was more uncommon than the large, noncalcific pseudocyst of the spleen, and also stressed the fact that trauma seemed to be a significant etiologic factor in the so-called nonparasitic type of splenic cysts. He, along with many others, emphasized that the spleen is known to enlarge during menstruation and pregnancy, and that this factor is believed to be responsible for the high incidence of splenic cysts in women of childbearing ages. He emphasized careful hematologic investigation with bone marrow and peripheral blood studies and roentgenographic examination in order definitely to diagnose the lesion prior to surgery.

Callahan[2] reported a case in a young woman who had a hard fall, striking the left upper part of the abdomen, about 13 or 14 years prior to development of a cyst. He, too, commented that the cyst contained numerous, shimmering yellow crystals, and that the cyst lining seemed to be composed of dense, firm hyaline connective tissue. Tamaki,[13] in 1948, stated that not a single case of a splenic cyst had been recorded in the surgical file at Jefferson Medical College Hospital since 1915. He referred to the experiences at the Mayo Clinic, where, during a 30 year period 800 splenectomies were done, and only 4 cases of cysts of the spleen were found. He reported a case in a 15 year old white boy; the cyst measuring approximately 20 by 33 by 14 cm., and weighing 3,300 Gm. This approximate size has been assigned to such cysts by several other authors.

Snyder[11] and also Lang,[6] reported cases in young women, one of whom was four months pregnant, and the other six weeks pregnant. Both were treated by splenectomy. Pratt-Thomas[9] reported a case in a 21 year old Negro woman with sickle cell anemia. Bean[1] recorded a case in a 21 year old man, the cyst being densely adherent to the left lobe of the liver and to the diaphragm. Neidhardt,[8] in reporting a case, stated that the cyst was ruptured during its removal, but that this seemed to diminish its size and make the surgical undertaking simpler and easier.

CASE REPORT

Miss D. W., aged 28, white woman, was examined in September 1953, for a swelling in the left upper portion of the abdomen. This had been present for two or three months and seemed to be gradually increasing in size. The increase in size has been more noticeable in recent weeks, since the patient started limiting her caloric intake in order to lose some weight. Her appetite had been good, although she felt a little full after eating meals and her stomach seemed to fill more quickly than formerly. She had not vomited, nor had there been any blood in the stools. The bowels had been regular. There had been no urinary tract complaints, nor had there been any chills or fever. At the age of 11 years, she had fallen down the steps and had sustained a rather hard blow with a fracture of the left leg below the knee. She had never had any type of abdominal trauma. She had had no abdominal operations or serious illnesses. Her mother, at age 27 years, had been operated upon in 1923, for a large abdominal cyst. She thought that this probably was due to a cyst of the kidney. The mother also had an abdominal exploration by us in 1943, for regional enteritis. At that

operation the left kidney was palpated and thought to be entirely normal. Careful attention was paid to this structure because of the previous history of having had a left nephrectomy for a possible cyst. The mother had again been operated upon by us in 1950, at which time a large serous cyst of the left ovary was removed. Again, the left kidney was palpated carefully and found to be intact. The left ureter also had been visualized at this procedure. The spleen, as well as other intra-abdominal organs, on palpation seemed to be normal.

This 28 year old white woman weighed 127 pounds. Her blood pressure was 110/80, and her temperature was 98 F. The most striking finding was that of a rounded, smooth, somewhat cystic mass in the left upper abdominal quadrant. This seemed to flare out the lower ribs and to extend to the crest of the ileum. It was nontender, and seemed to be fixed. No other solid intra-abdominal organs were palpable. The pelvic and rectal organs were entirely normal. The red blood cell count was 4,600,000 per cu. mm. with 10,300 white blood cells per cu. mm., 11.8 Gm. of hemoglobin, and a differential count of 82 per cent polymorphonuclear leukocytes, 15 per cent lymphocytes, and 3 per cent monocytes. The urine had a specific gravity of 1.020, and was free of albumin and sugar. There were a few epithelial cells in the centrifuged sediment. No blood or pus were noted. A clinical diagnosis of left upper abdominal tumor, probably cystic in nature, and possibly originating in the pancreas, was made.

A preliminary roentgenogram of the abdomen demonstrated a huge abdominal mass in the left upper quadrant. The lower extent was visualized a few inches above the crest of the ileum. This mass displaced the gas in the gastrointestinal tract inferiorly and to the right. It seemed to be homogeneous in opacity and did not contain any calcifications. A barium meal showed the stomach displaced inferiorly and towards the right. The roentgenologist, with these findings, thought that the tumor probably represented a pancreatic cyst, although he suggested a neoplasm of the kidney or adrenal gland. He stated that the appearance was not that of an enlarged spleen, although the splenic shadow could not be identified. Excretory urograms were made, with a normal appearance of the dye in 5 minutes from both right and left kidneys. The left kidney was displaced inferiorly and overlay the third and fourth lumbar vertebrae. Retrograde pyelograms were said to be negative for definite pathology. The impression from the roentgenographic examination was that of a mass in the left hypochondrium which did not appear to be in the spleen or stomach. The possibility of its being a tumor of the tail of the pancreas, or a retroperitoneal tumor was suggested.

Abdominal exploration, through a long upper left rectus incision, was made on Sept. 23, 1953. A large mass filled the left upper abdominal quadrant and extended upward high underneath the diaphragm and down below the umbilicus. At its inferior margin there was a triangular structure which seemed to be a remnant of the spleen, and which seemed to be attached to a large cyst which had displaced the stomach towards the right and inferiorly. The walls of the cyst were grayish in color and some areas seemed to be necrotic. The left lobe of the liver was densely adherent to the mass, but apparently not a part of it. The right lobe of the liver was entirely normal on palpation. The gallbladder was free of palpable stones. The mass had the appearance of a large cyst of the spleen.

Spenectomy was done. The dissection was started at the inferior margin of the mass where the blood supply entered the remnant of the spleen, and where it was easily isolated and ligated. After this had been done the cyst was dissected away from the left lobe of the liver by blunt and sharp dissection. As an effort was made to deliver it into the abdominal incision it was ruptured with the escape of a large quantity of greenish fluid containing many shining crystals. The cyst wall was densely adherent to the diaphragm, and this structure was entered in one area. After the cyst had ruptured it was easy to expose the remaining structures so that it could be removed rapidly. The rent in the diaphragm was closed with a few interrupted sutures of fine cotton. A small accessory spleen was seen and preserved. There were no palpable abnormalities of any of the other intra-abdominal structures. The patient's postoperative course was uneventful, although there were physical

findings of some fluid at the base of the left lung. This gradually cleared, and the patient was allowed to leave the hospital on her tenth postoperative day. She had since remained well.

COMMENT

This patient's findings were quite similar to others reported in the literature; the rather striking characteristics of all of them being that they were usually in young females who gave a history of trauma some years prior to the development of the abdominal mass. Added interest is attached to this patient in that her mother, at about her age, also had a large cystic tumor removed from the left upper abdominal quadrant, the exact nature of which remains unknown, but which possibly could have been a splenic cyst. The fact that what seemed to have been a spleen was palpated at two different operations at a much later date may have been due to the preservation and subsequent hypertrophy of an accessory spleen, somewhat similar to the one preserved in this patient.

These large abdominal tumors are of clinical interest primarily because they represent a problem in differential diagnosis, as well as in management. Figure 1 is the artist's conception of the appearance of the cyst as it was exposed at

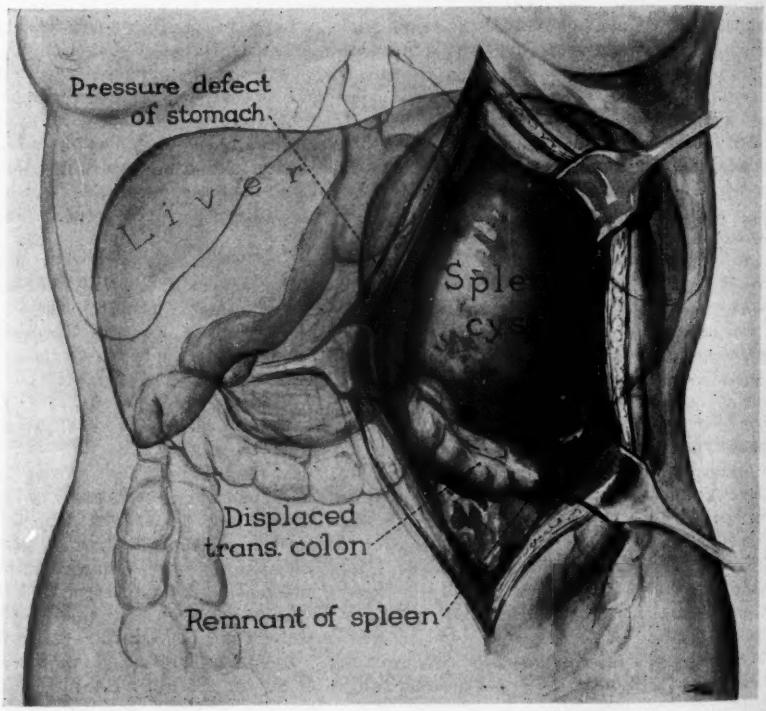

FIG. 1. Artist's conception of large pseudocyst of spleen. Note remnant of relatively normal spleen at the inferior pole.

operation. These large, thin-walled, rather vascular appearing structures present a very formidable appearance when first exposed at laparotomy, but apparently have been relatively easily managed, as was this patient, with a relatively low morbidity and mortality rate. In our patient most of the blood supply entered the remnant of the spleen at its inferior margin and was easily controlled. The cyst wall was thin and seminecrotic in areas, and although it was ruptured during its removal, the very fact that it ruptured reduced its size and made the dissection easier and more accurate in that it could be done under direct vision. The history of trauma years prior to the time of the development of this tumor is also interesting. One wonders whether or not these large cysts actually are not traumatic in origin, the capsule of the spleen and the splenic substance being partially ruptured, the organ subsequently gradually increasing in size due to repeated small hemorrhages.

The pathologist reported that the cyst measured about 15 cm. in diameter, and that it was filled with brownish fluid which apparently contained numerous cholesterol crystals. A remnant of the spleen remained and microscopic sections of this showed no significant abnormality. Sections of the cyst showed it to be lined by a thick layer of fibrous tissue. The pathologic diagnosis was, a large, benign, simple pseudocyst of the spleen.

SUMMARY

A large solitary cyst of the spleen occurring in a 28 year old white woman who had been subjected to rather severe trauma approximately 14 years prior to the time of surgery is reported. The patient's mother, as a young woman, and while she was pregnant, also had a large abdominal cyst removed, the nature of which is unknown, but which could also possibly have been a splenic cyst. These large cysts primarily are of interest from the standpoint of differential diagnosis and treatment. They seem to occur most often in women who have been subject to trauma. Their treatment consists in splenectomy with removal of the cyst.

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AXILLARY ADENOPATHY DUE TO CAT-SCRATCH

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Cat-scratch disease undoubtedly is widespread and frequently unrecognized. Because the primary cat-scratch is most frequently on the upper extremity, axillary and epitrochlear lymphadenopathy can occur.

Many cases of *blood-poisoning* may be cat-scratch disease. Because of the long interval between the slight trauma and its manifestation, the patient may have forgotten the initial cat-scratch. Outbreaks of the disease can occur centering about the family cat. It resembles mild tularemia. It is a systemic infection associated with malaise, fever and other transitory symptoms of general inflammation.[10] A specific sign of the disease is enlargement of the regional lymph nodes. Foshay[7], and Debré[4] recognized that axillary, epitrochlear or inguinal lymphadenitis could appear following a cat's scratch. The presence of axillary lymphadenopathy as the most common primary symptom of cat-scratch disease, is of extreme interest to the general surgeon. Removal of the enlarged lymph node is indicated both for diagnosis as well as for relief of pain and discharge—if present.

The etiologic agent has not been positively identified, although a virus is suspected.[2, 9] The lymph node, removed from a patient with the disease, can be prepared as an antigen (similar to the Frei procedure). A specific skin reaction appears in the infected patient.[2] Positive reactions have been known to persist for several years.[5]

CASE REPORT

On Aug. 7, 1953, J. S., a 7 year old white girl, was first examined because of a *lump in the right armpit*. The mother had noticed it the preceding day while bathing her daughter. The child had felt the lump about August 1. Subjectively the child felt well and evinced no malaise. Despite slight elevation of temperature (99.4 F.) she did not appear to be ill. Pulse and respiration rates were within normal limits. The right axillary area was slightly tender. An enlarged, fixed gland about 3 cm. in diameter was palpable. Abduction at the right shoulder was painful.

Because of the sudden development of a single, enlarged gland, without apparent cause, associated with slight elevation of temperature, Hodgkin's disease or one of the lymphomas was suspected.

The child was hospitalized on August 11. Roentgenogram of the chest and complete blood count were normal. Under general anesthesia, on August 12, the enlarged node was removed from the right axilla.

Bacteriologic studies, including culture and guinea pig inoculation for acid-fast organisms, were negative.

The irregularly oval lymph node measured 3 by 2 by 2 cm. When cut, the surface had bulging light yellow peripheral areas up to 1 cm. in diameter with scalloped borders. The central portion of the node was depressed, glistening and slightly translucent.

Microscopic examination of the lymph node showed considerable reticulo-endothelial

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hyperplasia. Scattered through the node were many small tubercle-like structures. The centers were composed of polymorphonuclear leukocytes, some of which were necrotic. Surrounding these were zones of large pale-staining epitheloid cells. Rare multinucleated giant cells of the Langhans type were present. The capsule of the node was fibrotic and inflammation extended into the surrounding connective tissue.

The histologic picture was considered consistent with the diagnosis of *cat-scratch disease*.[2]

Neither the mother nor the youngster at first recollected any episodes of recent cat-scratch. However, persistent questioning finally revealed that on May 30, 1953 (over two months previously) the child had visited an aunt and was slightly scratched upon the right forearm while playing with the household cat. Mercurochrome had been applied to the scratch. The incident had been dismissed from mind.

An intradermal test with 0.1 cc. of *cat-scratch antigen* (obtained by courtesy of Dr. W. B. Daniels) was made on Oct. 6, 1953. Forty-eight hours later there was a papule 1 cm. in diameter with erythematous pseudopodia 2.5 cm. in diameter. No papule or erythema appeared in the control area. Papule and erythema at test site decreased at 72 hours. Seven days after intradermal injection a brown papule measuring 8 mm. in diameter was present. Thirty days later a brownish papule, 5 mm. in diameter was still present.

The child has been well since excision of the involved gland. The incision healed. No other nodes were palpable.

DISCUSSION

The clinical entity *cat-scratch disease* can be confused with more serious disease as well as with simple superficial infection originating in the extremities.

This condition may develop following direct contact with cats, or with thorns, bushes, and household articles with which cats come in contact.[1] It is characterized by (a) regional lymphadenitis and occasional suppuration, usually preceded by (b) an initial cutaneous lesion which heals rapidly and well. Fever and systemic symptoms are not usually distressing. It is usually an indolent self-limited condition. Recently, however, several cases of encephalitis have been reported.[3, 11]

In the present case, over two months elapsed between the cat-scratch and the appearance of regional axillary adenopathy. About 14 days after the scratch occurred, this child had a brief malaise, coryza and slight cough with oral temperature of 99.4 F. for 48 hours. No other signs were present in the 60 day interval. Of importance is the fact that, at first, no cat-scratch was recollected by the child or her parents.

Microscopic examination of the excised lymph node usually will suggest the diagnosis.[12] Bacteriologic study to differentiate from tularemia, tuberculosis or other granulomatous disease may be necessary.

Intradermal injection of 0.1 cc. of the specific cat-scratch antigen is necessary to make a positive diagnosis. In the case reported, a positive skin test was obtained two months after removal of the regional lymph node and approximately four and one-half months after the original cat-scratch.

It is suggested that when feline contact has been present, regional lymphadenopathy may be evaluated by use of intradermal test with the *cat-scratch* antigen. A positive reaction would allay fears concerning the presence of a serious lymphoma. Surgical excision would then be indicated for pain or discharge from the lesion rather than primarily for diagnosis.

SUMMARY

A case of *cat-scratch disease* in a 7 year old girl with full recovery, is reported. Axillary adenopathy brought the patient to medical examination and surgical treatment more than two months after the original forgotten episode of the cat-scratch.

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EDITORIAL

CAN INJURY CAUSE BREAST CANCER?

When a lump in a woman's breast proves to be cancer, quite naturally she seeks a cause upon which to blame it. If a blow or a fall is remembered the connection seems reasonable to her. And the belief that injury has been responsible is not weakened if there is hope of financial award.

With the growth of workmen's compensation systems and the increase in personal injury litigation, determination of the relationship of trauma to cancer became increasingly important. A specific cause of neoplasia being unknown, medical science found itself in the position of being unable to exclude contusion, at least as a material factor.

Looking toward establishment of a reasonable basis for judicial determinations, the subject was considered at the French Congress of Surgeons in Paris in 1907 when Segond presented his paper, since then widely quoted, and again at the Second International Congress on Cancer in Paris in 1910 (Bérard and Thiem). The discussions at these congresses received wide attention and were largely responsible for acceptance of certain conditions, fulfilment of which should be required before injury properly could be assigned as the cause of a cancer. Various modifications have been suggested before and since but, in general, the conditions are as follows:

1. It must appear that no tumor existed before injury.
2. The injury must have been of reasonable severity.
3. It must have occurred at the site of later tumor growth.
4. The cancer must arise (or be observed first) within *reasonable* time limits, often set quite arbitrarily at not less than three weeks nor more than three years after injury.

Among modifications proposed perhaps the most important was the requirement of *bridging* signs or symptoms continuously present between the time of the injury and the appearance of cancer. Why there must be any clinical signs or symptoms between disappearance of the ordinary effects of injury and the time when a microscopic neoplasm reaches appreciable size seems anything but clear. (For an extended account of the development of required conditions reference is made to the excellent Résumé of the Literature on Trauma and Tumors by Leila Charlton Knox.)*

Obviously these conditions were formulated empirically rather than based upon scientific evidence. Their very tone suggests doubt that a single injury may actually be responsible for cancer. Yet their effect has been just the opposite—to put the seal of recognition on trauma as a cause. During the past 30 or 40 years a vast body of legal precedent based upon them has grown up. So well established has the concept of traumatic origin of cancer become that, in damage suits for

* Knox, L. C.: Trauma and Neoplasms, Brahdy, L., and Kahn, S.: Trauma and Disease; (Second Edition), Chapter XV, Philadelphia, Lea and Febiger, 1941, p. 468.

injuries to the breast, claims are made even for increased likelihood of development of cancer in the indefinite future.

Knowledge of neoplasia has expanded in many important directions. It has become much better understood, for example, that tumors include a great variety of quite different and complex growth processes certainly not to be explained by any single common cause. Of most significance, the whole field of specific chemical carcinogenesis has developed since these conditions were formulated. It appears that a reexamination of them, clothed as they may be with the authority of age, is long overdue.

Viewing them in connection with the breast and assuming for the moment that a single blow could under any circumstances cause cancer in this organ, what of the inherent validity of the conditions?

The first, that it appear that no tumor existed before the injury, is seldom possible to satisfy. It is rare indeed that there has been competent medical examination shortly before an injury and the statement of a patient, however honestly made, that the breast contained no lump is notoriously valueless. In the period immediately following injury determination of the presence or absence of a tumor lump often is handicapped by swelling, induration and perhaps hematoma. The usual fact is that injury serves only to direct attention to a previously unnoticed tumor. And a densely hard cancer, contrasting with soft, yielding breast tissue about it, actually may localize the injury and its signs.

The second condition, that injury must have been of reasonable severity, is vague in the extreme. How much pain? How much, if any, swelling or discoloration? Determination is again frequently dependent upon statements of the patient. Several weeks or months after injury and influenced by the seriousness of the situation now discovered—these well may be exaggerated even without conscious intent.

With the third condition, that injury must have occurred at the site of later tumor development, there can be no quarrel but even this often is difficult and uncertain of establishment. When, for example, there has been a fall, in the absence of an exact record of discoloration or hematoma it well may be impossible to be sure that a particular area of breast received damaging injury.

The fourth condition, that the tumor must be first observed within from three weeks to three years, will certainly not stand in the light of modern knowledge of carcinogenesis. One fact, common to cancer-producing agents in general, is that exposure must be over several years in the human being and over proportionate periods in the life span of animals. That any process started by a blow could result in cancer within a few weeks or months is not in accord with known facts. To digress for a moment from the breast and from injury by mechanical contusion, the three year rule would exclude virtually every instance of the one form of cancer well recognized as traceable to a single injury, epitheliomas in burn scars. The average interval from burn to tumor is about 14 years. Obviously the conditions themselves will not stand the light of critical appraisal.

But what could a single contusing blow do to start a process of carcinogenesis? Tissues may be forcibly separated; there may be crushing; epithelial boundaries

may be broken; hemorrhage produced and the processes of cell multiplication and repair set up. But does not every surgical operation for a benign lesion of the breast result in precisely these insults to tissues? Yet quite properly no surgeon worries about increasing his patients' risk of cancer for the future. Considering the number of breasts operated upon for benign lesions the instances of cancer arising at the site of a surgical scar are very rare indeed (the author has seen 3 in 30 years) and are explainable on the basis of coincidence alone for there is, of course, breast tissue in and about surgical scars subject to cancer development just as elsewhere in the organ.

What of the possibility that an injury might cause a *precancerous* lesion to become malignant? Recognizable benign breast lesions with cancer-producing potential are few. The only one of importance is papillary disease of substantial extent. This is relatively uncommon itself and reports of trauma preceding cancer development in association with it are virtually nonexistent.

The theory may be advanced that clinically unrecognizable chronic irritative processes in the breast, such as low grade inflammation or stagnation of secretions, may predispose to cancer and that injury might be a precipitating factor. The innocence of surgical injury should be decisive here, for certainly if any breasts are subject to such chronic processes it should be the ones harboring cystic disease in its various forms and these are the breasts most commonly subjected to local removal of lumps.

All these considerations appear sufficiently compelling. It is time to take an unequivocal position that breast cancer is not caused by injury.

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EDITORIAL

PAIN AND EFOCAINE

Treatment of acute and chronic pain has been a medical problem for centuries. Relief of acute pain has been achieved by the use of narcotics, barbiturates, and short acting local anesthetic agents. The anesthetic drugs with action of short duration in clinical use today have a low toxicity and are extremely effective. These drugs produce analgesia which is completely reversible and leave no neurologic sequelae in the vast number of instances of their use.

Chronic or continuous pain, the cause of which is unknown, or, if known, defies pharmacologic relief, still constitutes a major surgical and anesthesiologic problem. All of the drugs used for relief of chronic pain have certain drawbacks, related either to their systemic toxicity, or to their irritative qualities in the tissues themselves, or to their actual permanent destruction of nervous tissue.

In 1952 Efocaine, which contains 0.25 per cent procaine hydrochloride, 1 per cent procaine base, 5 per cent butyl-para-aminobenzoate in a solvent containing 2 per cent polyethylene glycol, 78 per cent Propylene glycol and 20 per cent water, was introduced as a drug capable of producing nerve block of 5 to 14 days duration. This agent was investigated clinically by many groups because of the tremendous need for a prolonged acting local anesthetic drug. As with most new drugs, there were early enthusiastic reports, claiming low toxicity and the lack of postinjection sequelae.

We were among the early users of this compound and became early advocates of the drug, so much so that in the extremely poor-risk postmitral valvulotomy patients in whom we did not want pain to be a factor in preventing good respiratory exchange in the early postoperative period, we resorted to paravertebral nerve block to control postoperative pain, using 2 cc. of Efocaine at each thoracic nerve involved in the surgical incision.

The first 30 patients experienced satisfactory relief of postoperative pain. Then 2 transverse myelitides after the use of Efocaine were encountered; 1 patient completely recovered, and the other died from disseminated carcinoma. The autopsy in the latter case showed marked degeneration of the myelinated fibers and a spongy condition of the cord consistent with toxic myelopathy.

Simultaneously with our observations, reports began appearing in the literature indicating the same untoward sequelae, and it now appears obvious that Efocaine can be extremely damaging to the tissues and to the nerves themselves. We therefore make a strong plea that Efocaine be abandoned, especially for use in the paravertebral region.

With the abandonment of Efocaine, our need persists for an innocuous, but effective, long acting drug. Many drugs have been suggested, but all have fallen short of the ideal.

Our experience, we believe, has been another example of the use of drug therapy in human beings producing disastrous results before adequate basic anatomic, biochemic, physiologic, and pharmacologic studies have been completed in the experimental animal.

Below are reported, in brief, the 2 cases mentioned above which are exemplary of the toxic effects, both local and systemic, of this compound.

Case 1. A 25 year old white woman was admitted on Jan. 13, 1953 to the obstetrical pavilion of The New York Hospital. She was in her fourteenth week of pregnancy. A diagnosis of mitral stenosis and mitral insufficiency, with impending cardiac failure was made.

On Feb. 18, 1953 a mitral valvulotomy was performed. Immediately following the operation, a paravertebral somatic block of the left second, third, fourth, and fifth thoracic nerves was done, using 2 cc. of Efocaine at each site. On the second postoperative day, she complained of inability to move the left leg and inability to void. The significant neurologic findings at this time were: 1. Decreased motor power and flaccid musculature of the left lower extremity. The right lower extremity appeared normal. 2. Hypalgesia from thoracic 6 to thoracic 10 anteriorly and posteriorly. Vibration and touch intact. The impression was that the patient had a partial myelitis at the level of thoracic 6 to thoracic 10 due to Efocaine.

On the fourth and fifth postoperative days slight improvement was noted and a diagnosis of radiculomyelitis secondary to Efocaine was well established. The patient's cardiac status improved, and she was placed on physiotherapy. She continued to improve over the next four week period and was discharged on the thirtieth postoperative day walking with only slight residual difficulty. She since has made a complete recovery with no demonstrable sequelae.

Case 2. A 63 year old white man was admitted on Dec. 17, 1952 to the surgical pavilion of The New York Hospital with the chief complaint of shortness of breath and a sensation of discomfort and pain in the left chest of five weeks duration.

A diagnosis of a lesion in upper lobe of the left lung was made, a left thoracotomy was done under general anesthesia on Dec. 29, 1952. The lesion was found to be unresectable.

Postoperative pain was severe and on the eighth postoperative day a 2 per cent procaine block of thoracic 5, 6, 7, and 8 left intercostal nerves was done with good relief for 12 to 18 hours. On the ninth and tenth postoperative days procaine blocks were unsuccessful in achieving pain relief. On the tenth postoperative day a somatic paravertebral block of thoracic 5, 6, 7, and 8 on the left was done using 2 cc. of Efocaine at each site. Approximately 7 to 8 hours later the patient was unable to get out of bed because of weakness of the lower extremities. Pertinent findings at this time were: 1. Paresis of dorsiflexion and eversion of the foot, flexion at the knee and hip, internal paresis of adduction and abduction of the thigh on the left. 2. Diminution of the left patellar and hamstring reflexes on the left with an equivocal left plantar response. 3. Dysesthesia and dysalgesia below thoracic 4 on the left. 4. Impairment of superficial and deep pain on the right below thoracic 4 with touch intact. 5. Impairment on vibratory sense on the left to the costal margin. 6. Atonic neurogenic bladder.

The impression was that these findings were consistent with a Brown-Sequard syndrome.

The patient was treated with radiation therapy to the lung and physiotherapy for his extremities. By Jan. 20, 1953 he had improved slightly. On February 7 he was observed still to have paralysis of the left lower extremity and loss of sensory function on the right from thoracic 4 down, an atonic bladder, and a poorly functioning bowel. He became progressively worse and died April 11, three and one-half months postoperative.

The autopsy findings were: 1. Carcinoma of the pancreas with obstruction of the bile ducts and jaundice, and metastatic carcinoma in pleura, pericardium, lungs, liver, adrenals, and lumbar vertebrae. 2. Toxic transverse myelitis. "Myelin sheath stains of the thoracic region of the spinal cord show a marked degeneration in the fibers of the gracilis column. There is also a degenerative condition of the myelinated fibers around the periphery of the cord where a spongy state is present. This condition extends to the lower cervical level. One posterior root in the thoracic region appears to be partially degenerated. The myelin sheaths do not stain normally. This condition is consistent with a toxic myelopathy."

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BOOK REVIEWS

The editors of The American Surgeon will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.

A Synopsis of Anesthesia. By: J. Alfred Lee, M.R.C.S., L.R.C.P., M.M.S.A., D.A., F.F.A.R.C.S., Consultant Anesthetist to the Southend-on-Sea Hospital, etc., Third Edition, With 72 Illustrations. Baltimore; The Williams and Wilkins Company, 1953, Price $3.50.

The author, due to the changing concepts and advances made both in the theory and practice of Anesthesiology during the past few years, has completely revised his "Synopses of Anesthesia" in this his third edition.

As in the first edition the author has avoided controversial data and has presented only factual information. Completeness is obtained by the addition of new chapters including the ganglionic blocking agents for hypotensive anesthesia and the ultra short acting muscle relaxants.

Surgeons will find in this "Synopsis" a source of reference readily available and concise.

Paul H. Lorhan, M.D.

Surgical Infections; Prophylaxis—Treatment—Antibiotic Therapy. By: Edwin J. Pulaski, M.D., D.M.Sc (Surgery), Lieutenant Colonel, Medical Corps, United States Army, Deputy Director, Division of Surgery, Walter Reed Army Medical Center, Assistant Chief, Surgical Service, Walter Reed Army Hospital. Charles C Thomas, Publisher, Price $7.75. Springfield, Illinois, U. S. A.

The purpose of this 332-page text is a specific one. The author is particularly well qualified to present to the reader the general and theoretic considerations of antimicrobic therapy. His experience permits an authoritative monograph on the use of the special antibiotics, and the extensive laboratory and closely associated clinical material available to him has enabled him to provide the reader with specific information on the proper place of antibiotic therapy in surgical infections.

An excellent chapter is presented on the prophylaxis and management of wound infections, including burns.

The application of antibiotics to specific infections is thoroughly discussed in a separate chapter. Regional wounds and infections are discussed in the remaining chapters.

This text is essential reading for all levels of medical practice and particularly for those physicians concerned with surgical infections. It stresses the appropriate use of antimicrobic therapy as well as properly delineating such therapy as "adjunct" therapy, and not substitute therapy for sound surgical measures. It is believed that the reader of this book will appropriately upgear his thinking and become more specific in the use of antibiotic drugs.

Robert G. Rate, M.D.

Hepatic Circulation and Portal Hypertension. By: Charles G. Child, III, M.D. Professor of Surgery, Tufts College Medical School, Chairman, Department of Surgery, New England Center Hospital; Formerly Associate Professor of Clinical Surgery, Cornell University Medical College, Attending Surgeon, New York Hospital. From the Department of Surgery and the Laboratory of Surgical Research of the New York Hospital—Cornell Medical Center. In Collaboration with Ward D. O'Sullivan, M.D., Mary Ann Payne, M.D., George R. Holswade, M.D., Roger Milnes, M.D., Arthur L. Gore, M.D., Daniel M. Hays, M.D., Roy D. McClure, Jr., M.D., Helena Gilder, M.D., Charles

S. Harrison, M.D., David Barr, M.D., Earl A. O'Neill, M.D. Illustrated. W. B. Saunders Company, Philadelphia and London, 1954. Price, $12.00.

This volume is a useful addition to the library of any student interested in the problem of portal hypertension. A basic review of the anatomy, physiology, embryology and vasculature patterns of the liver is presented. A very good chapter is given on the preoperative and postoperative water, electrolyte, and protein balance in patients with cirrhosis.

Of practical importance are the author's criteria for the surgical selection of patients to undergo shunting operations. The reader will immediately grasp the significance of the section on portal venography as a diagnostic aid in the selection of either a splenorenal or portacaval shunt. The expansion of radical surgery of the pancreas for carcinoma when the portal vein is involved is reported with clinical success.

An appendix reviewing original experimental work and detailed case reports is presented.

CREIGHTON A. HARDIN, M.D.

Thoracic Surgery. Second Edition. By: RICHARD H. SWEET, M.D. Associate Clinical Professor of Surgery, Harvard University Medical School. Illustrations by: Jorge Rodriguez Arroyo, M.D. Formerly Assistant in Surgical Therapeutics, University of Mexico Medical School. W. B. Saunders Company. Philadelphia and London; 1954.

As in the first edition, Dr. Sweet has based this volume on the concept that a properly qualified surgeon can acquire proficiency relatively easily in thoracic operative procedures by employing the technics described.

The organization is arranged on a regional anatomic basis, with chapters on thoracic surgical anatomy, armamentarium and incisions, surgery of the chest wall, pleural cavity, lungs, mediastinum, thoracic duct, esophagus, and the diaphragm. A separate chapter treats of abdominal surgery approached via the thorax.

The subject matter is presented in a concise, clear style, with major emphasis on surgical technic, with adequate coverage of the very important preoperative and postoperative care. The illustrations are profuse and are of very high quality. Their graphic reproduction is very good.

This book has condensed a great deal of information into a relatively small space, and yet has left little or nothing to the imagination of the reader. It has well fulfilled the author's intent.

THOMAS G. ORR, JR., M.D.

BOOKS RECEIVED

Books received are acknowledged in this section, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Seventy-Five Years of Medical Progress. 1878–1953. First Western Hemisphere Conference of the World Medical Association. Edited and with a Foreword by; LOUIS H. BAUER, M.D., F.A.C.P. Secretary-General, The World Medical Association; Past President, The American Medical Association. Lea & Febiger. Philadelphia, 1954.

Histopathologic Technic and Practical Histochemistry. By: R. D. LILLIE, A.B., M.D., Medical Director, U. S. Public Health Service; Chief, Pathologic Anatomy Service, Clinical Center, National Institutes of Health; and Chief, Laboratory of Pathology and Pharmacology, National Institute for Arthritis and Metabolic Diseases. The Blakiston Company, Inc. New York, Toronto. Price $7.50.